The Journal
of the
Mysore Agricultural
and
Experimental Union

Vol. XIV. No. 4

The Mysore Cattle-Breeding Station, Ajjampur

BY

C. Narasinga Raju, L.Ag.

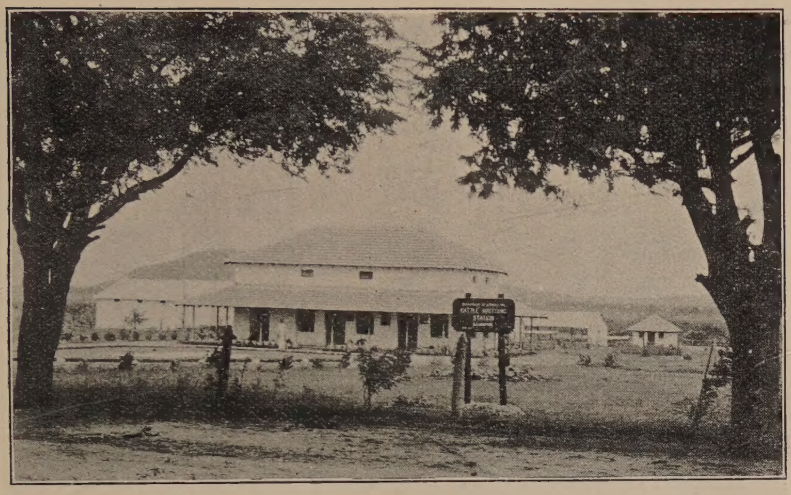
Several important schemes calculated to have far-reaching and permanent influence on Mysore Agriculture were launched out during the past five years and the establishment of a cattle-breeding station on scientific lines is one of them.

Mysore produces some of the best breeds of draught cattle in India and she is famous for the large trade in cattle carried on in several places every year. "Hallikar" and "Amrutmahal" are the two typical breeds of Mysore cattle. They differ in conformation and other features from the North and other South Indian breeds. The "Hallikar" is the most usually raised high class breed in all the important cattle-breeding tracts of the State. Breeding of Amrutmahal cattle has been, for a very long time, under the control of the Government. Amrutmahals excel Hallikars in three important respects, *viz.*, endurance, thriftiness and spirit. These characteristics are the result of long continued breeding under almost natural conditions. Very few private bodies or individuals attempted to raise this breed till last year, when special concessions were granted by the Government to facilitate private enterprise. The scheme has so far been able to attract eight private breeders. Although Amrutmahals

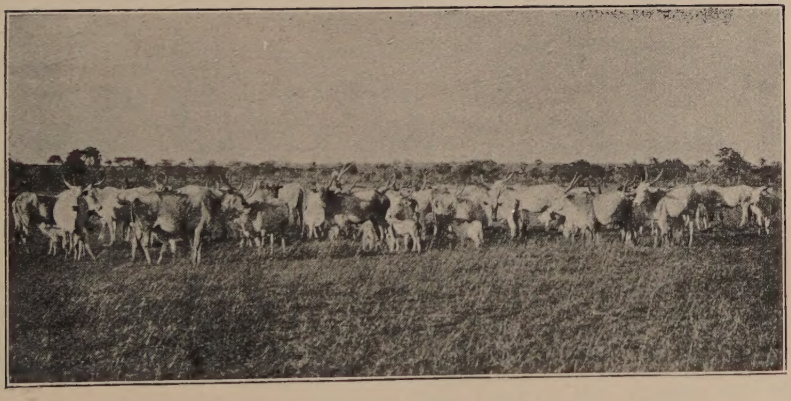
are very good for draught purposes, Mysore ryots have not taken to them as freely as one would expect. This is because, they can easily procure equally good Hallikars which are easy to handle and train for field work. Apart from these two high class breeds there are other breeds which form the bulk of the village cattle. These are very poor both from the point of view of draught as well as yield of milk. The establishment of a cattle-breeding station is the outcome of a comprehensive scheme to raise the standard of village cattle and to improve the existing good breeds which are showing signs of deterioration. The main object of this station is therefore to produce and supply first class breeding bulls for the benefit of the Mysore ryots.

The station was established in the year 1929-30. When it is fully stocked, it will probably be the second largest of its kind in India. For want of sufficient grazing ground and other facilities in one and the same place, the work is being conducted on two stations about twelve miles apart from each other. The main station is located about a couple of miles from the Ajjampur Railway Station on the Tarikere Road and is situated at an altitude of about 2,500 feet. It consists of 650 acres of rich black soil with plenty of lime. About a hundred acres, studded with jali trees (*Acacia arabica*) form the tank bed of Parvatharayanakere. Two hundred acres have been brought under cultivation. The tank bed area gives the bulk of hay of an excellent quality. The entire area is protected with wire fencing. Three miles from the main station, and attached to it, is another kaval 635 acres in extent which is used for the purpose of grazing and making hay. The sub-station has an area of 2,469 acres. Attached to it are two kavals with a total area of 1,651 acres. No cultivation is carried on in this station. About 200 acres are moved every year to make hay. Both the stations are well supplied with water, but not sufficient enough to grow irrigated crops. Within a radius of twenty miles from these stations, there are 25,000 acres of Amrutmahal kaval land which can be utilised for expansion of the station in future. The total area of all the kavals now used is nearly 5,500 acres. Rainfall on both the stations is sufficient and well distributed, the average for the past four years being 32.55 inches at the main station and 30·5 inches at the sub-station.

On the main station cows in milk with their calves, breeding bulls



Front view of the main station.



A batch of cows with baby calves.

Cows stalled for milking.

Amrutmahal breeding bulls.

for sale and bullocks for training in addition to working bullocks required for farm use are maintained. The sub-station is meant for dry stock and young stock of 1 to 3 years old. After calving, the cows are transferred from the sub-station to the main station where they are trained for milking. Such of the bull calves as are selected for breeding purposes are handled to a certain extent and sent in their third year to the main station where they are domesticated. Recently another sub-station has been opened in Abbanaghatta, near Arsikere, to which two to three year old selected bull-calves have been transferred for roping and training.

The foundation stock for the breeding station is all selected from the Government Amrutmahal herds. The total strength is 1,139 of which 322 are cows. This is a little over one-third of the proposed full strength of cows alone. The cattle are reared on these stations in as natural a manner as practicable with the object of preserving the hardiness of the breed. The aim in breeding is to produce bulls of first class quality which will not only give good draught bullocks but also improve, to an appreciable extent, the milk yield. The method adopted to achieve this end is selection, weeding, grading and judicious crossing with a breed not very different in characteristics from the Amrutmahal breed. It need hardly be said that the improvement of live-stock is a slow and laborious process. If we remember that it has taken generations in western countries to evolve the present excellent breeds of cattle, sheep and other classes of live-stock, the four years that have passed since the establishment of the station is too short a period to expect any very striking results.

During this period a good deal of work has been done in erecting buildings, fencing, construction of paddocks, cleaning pasture and bringing land under cultivation. Besides, very useful and important data which form the basis of future work of systematic breeding have been collected. It is not possible within the scope of this article to discuss fully all the important facts gathered so far and how they have been made use of. Only a few of the more important ones are discussed below :—

1. Although the Amrutmahal bulls bred on the station are of the best available type, they are still found deficient in certain characteristics as the stock has been bred in a haphazard manner for some

time past resulting in the transmission of certain undesirable characters to their off-spring. To eliminate these characters three Hallikar bulls of the best procurable type have been imported and allowed to serve a group of cows. The result obtained by introducing the Hallikar blood into the herd is encouraging and striking. In a preliminary selection of bull calves for breeding purposes, it was found that over seventy per cent of the selected calves were born to the Hallikar bulls and the rest to the Amrutmahal bulls. Further, the birth weight of the calves born to Hallikar bulls is eight per cent more than that of the Amrutmahal calves.

2. It was found that the calvings were mostly in the months of July and August when the weather prevalent here is very inclement for young calves. It was also found that the production of milk was not evenly distributed throughout the year. To tide over these difficulties the herd has been divided into patches and bred in two or three seasons, with the result, that the calvings are, to a great extent, uniformly distributed over different seasons of the year.

3. With a view to finding out the actual milking capacity of the Amrutmahal breed, of which no accurate information was available hitherto, a record of milk yield of all cows kept on the station is maintained. The yield is recorded once in three or four days according to season. On days when there is no recording, the calves have the full share of mother's milk except in cases of heavy yielders. The records maintained for the past three years show :—

(*a*) that Amrutmahals are poor in milk yield, the average per head per day of the milking herd being only 3.8 lbs. containing on an average 4.5 per cent of fat, (*b*) that the herd average has been raised from 2.7 to 3.8 lbs. during the last three years, (*c*) that the dry period is long, and (*d*) that there are individuals which give nearly double the herd average with a short dry period, from which a milk strain, without affecting the draught qualities of the breed, can be built up by judicious mating and feeding. A three-year old bull whose mother (now 16 years old) has given 5.1 lbs. of milk on an average during the last three lactations and has had a short dry period, has been put on a batch of cows from this year. The value of this mating can be estimated only after five years from now. We can hardly hope to evolve dairy animals from the Amrutmahal breed,

Hallikar breeding bulls.

A group of Amrutmahal breeding bulls for sale.

but there is no doubt that breeding bulls, selected on the basis of milk yield as well, will greatly improve the village milk supply.

4. The Amrutmahal heifers generally mature about the fifth year. Proper feeding and careful management from their young age have not only influenced their development and growth but also hastened their maturity. Almost all the calves brought up on the station have taken the bull at the age of three, a factor of considerable economic importance in breeding.

5. By careful weeding and management the percentage of births over cows of calf-bearing age has been increased from 40 to 66 and the average yield over the milking herd has been raised from 2.7 lbs. to 3.8 lbs. of milk per head per day.

Two kinds of experiments, one on calves and the other on cows are being conducted. Two lots of calves of different age have been put on special ration to compare the difference in development and growth of these with those of calves subsisting entirely on pasture. The weights and measurements of sixteen different parts of the body are taken at regular intervals. A marked improvement in the general build of calves fed on concentrated ration is noticeable. It is too early to say to what extent the feed given influences the development of several parts of the body at different stages of growth. The Imperial Physiological Chemist is analysing the blood of twelve selected cows at different seasons of the year to find out how far, principally, calcium and phosphate content of the blood is affected in different seasons and if the variation in the contents of these mineral constituents influences the œstrum.

As the regular breeding operations commenced only as lately as 1930-31, no breeding bulls, born to station stud bulls and reared on the station, are available for distribution. However, in order that the ryots might derive benefit from the station early, two and three year-old bulls from various Amrutmahal herds were being selected every year and brought over to the station for domestication and distribution. Eighty-two of these bulls have been given over to Village Panchayets and private individuals. Although these bulls are undoubtedly far superior to bulls generally kept in the village herds, the ryots do not appreciate them, because they are considered wanting in facial expression and markings of Hallikar breed, which the ryots, particularly those from the maidan districts,

like. Our Hallikar Amrutmahal cross-breeds will, it is expected, satisfy them. A dairy equipped on a modest scale with modern appliances is attached to the station. Most of the milk is converted into table butter for which there is steady and adequate demand. The separated milk mixed with other feed is all fed to young stock.

The cattle are reared, as already mentioned, in as natural a manner as practicable to preserve the hardiness of the breed. All the animals, excepting cows to be milked, baby-calves, breeding bulls and working bullocks, are kept in open *roppas* (enclosures) exposed to all sorts of weather. The animals graze in groups made according to age and sex, on different blocks of pasture and in rotation. The bulls are allowed in the herds during day time only. Excepting working bullocks and cows in an advanced state of pregnancy, all the other stock at the sub-stations subsist entirely on pasture. The stock at the main station, excluding working bullocks and stud bulls which get concentrated ration throughout the year, are given concentrated ration in addition to roughage, from January to July only. Concentrated feed consists of three parts of groundnut, one part of wheat bran and one part of rice bran and in addition, two per cent of salt and one per cent of bone meal. The quantity of the last two ingredients varies with age in the case of calves. Three pounds form the maximum quantity given to adults other than working bullocks which get 4 to 6 lbs. depending upon the season. The quantity given to young stock varies from a quarter to one and a half pounds per day. As far as possible, hand feeding of motherless and weak calves is avoided by drafting them to heavy yielding cows which are trained to take two or three calves. Of course, these cows are put on special ration.

All the cattle are protected against Rinderpest. The young stock are also inoculated periodically against Black-quarter. There has been no outbreak of Rinderpest in the herds and the mortality due to other contagious and epizootic diseases has been very low, although in one year a fairly good number of young stock succumbed to Black-quarter. The mortality last year has been only six per cent.

Pasture on the whole is good enough even though clearing of bushes is yet to be done. This work is being pursued as far as funds permit. The main station pasture is about the best; the grass consists mostly of two or three heavy-yielding and nutritious varieties. A few exotic varieties of grasses are also being tried. The

average yield of hay is half to three-fourths of a ton per acre, depending upon seasonal conditions. Harvesting of grass for hay-making is all done by bullock-power machinery. The total area mowed in both the stations is about 500 acres. Experiments are being conducted in connection with manuring of pasture with artificial fertilisers.

Fodder crops, comprising jola and sun-flower are being grown on two hundred acres in the main station. Soy beans and cluster-beans are under trial in rotation with other crops. The crops raised are all rain-fed. When conditions permit, two crops are taken in a year. All the green fodder is converted into ensilage in trenches. Five to six hundred tons of ensilage are prepared every year and fed during summer months to all classes of stock on the main station in combination with a little quantity of chaffed hay. The Imperial Physiological Chemist is also conducting feeding experiments with grass and leguminous hay prepared on this station. The results are not yet available.

An account of the station, its development and the results obtained so far are given in the foregoing paragraphs. The object with which this station was established will not be gained without the active co-operation of ryots and private cattle breeders. It is earnestly hoped that such co-operation will be forthcoming.

Casuarina Plantations in Mysore

BY

H. Sreenivasa Rao

Retired Deputy Conservator of Forests

Although casuarina is an exotic plant it is extensively cultivated in the maidan districts of Mysore. It is very common in the Kolar and Bangalore districts. In eighteen seventies Government opened extensive casuarina-cum sandal plantations in the Kolar, Bangalore and Tumkur districts appointing a separate divisional Forest Officer for the purpose. As the first planted casuarina in the Government Plantations were all cut out these areas have now become mere sandal reserves with a great deal of jungle wood and thorns which have sprung up spontaneously. The profitableness of casuarina plantations gave an impetus to the ryots of the country and they have taken

to planting the tree on a large scale as there is much demand for its fuel. It is largely used as scantlings for *kaccha* (inferior) buildings and as props in the Kolar Gold Mines. It is a rapid growing tree which can be grown without much trouble. It commands a ready market and a good price which is got in a lump sum. It is therefore cultivated on a large scale. The following is a brief account of its cultivation.

1. Soil.

Low lying sandy loams and loamy soils are the best suited. Clayey soils, especially those which crack during hot seasons, are unfavourable. If the sub-soil moisture is nearer the surface the trees grow to a very large size. Fairly good-sized trees can be grown even on elevated situations if the soil is a loamy flat.

2. Seed Collection and Nursery.

The fruit matures and turns slightly yellow about the months of December and January. Ripe fruits collected from old trees are dried in a windless place for two or three days. The fruits then dehisce and throw out the fine chaff-like seeds. They are collected and dried well. Seed is sown in February in finely prepared nursery beds about 2 to 3 feet square and lightly covered with soil and a layer of straw. The beds are watered daily by means of a water pot. Till the time when the seeds germinate and grow to a height of 2 or 3 inches the beds are covered with a layer of neem leaves to prevent the attack of ants which, otherwise, eat away the seeds. Ashes are also applied to check the attack of ants. The covering over the beds is removed when the plants are 4 to 5 inches high when they should be pricked out into nursery beds prepared in loamy or clay-loamy soils or into tile-pots set in beds of hundred or so and filled with earth. Nursery beds should be periodically watered till the plants are of the height of a foot to foot and a half, when they are fit for transplanting finally. If the plant has a tender and somewhat leading shoot at the time of final planting, the transplant will die down to about half the height in the absence of rain immediately after transplanting, whereafter it has to shoot up from the stum left. In order to avoid this set-back it is better to discontinue watering the nursery beds for about a month (watering occasionally to prevent drying up) before final planting. This checks further growth in height and makes the tender shoot woody and hardy to withstand the shock of transplanting.

3. Pits for Planting.

In Government plantations yard pits are dug in spots 13 feet apart. In private plantations 1 to 2 or 2½ feet cube pits are dug 6 to 9 feet apart. In 6 feet spacing plants will be very much crowded and the growth will be poor unless the soil is rich. Nine feet spacing is good. Usually ryots plant the young plants in small pits six feet apart in fields under cultivation. If trees are to develop both in height and thickness yard pits with a spacing of 9 to 13 feet must be adopted. The pits should be dug one season prior to planting. If pits stand open for a long time the soil gets weathered and white-ants do not attack the transplants. In pits dug just before transplanting the chances of attack by white-ants are great (especially in red soil), if moisture is insufficient after planting.

As the surface of land in the Mysore State is generally of an undulating nature (except in tracts of black cotton soil) the casuarina plantations are situated on soils of varying degrees of incline. The dug-out of pits should be thrown on its lower side in a semi-circular form ; and while refilling it for transplanting only about three-fourths of the earth should be thrown into it leaving the fourth part in a semi-circular bund on the lower side. This retains rain water flowing from the higher side in the hollow of the pit and greatly helps the plant's growth. Care should be taken to see that there is no water in the pit while being filled up and that the earth for filling in is moist.

4. Transplanting and After-Treatment.

Success greatly depends on the time of transplantation. Good rainy weather with frequent showers should be selected. Immediately after heavy rains when the filled up earth is fully moist the transplants (if they happen to be the ones transplanted in the earth without tile-pots) are brought to the site with clods of earth or with the tile-pots (with plants) as the case may be and inserted with the clod of earth into a hole made in the pit. In case of tile-pot plants, the tiles are removed by pulling them asunder. The plant is then well fixed by filling the hole with earth and treading all round. If there is no fall of rain within a day or two after planting it is better to water the transplants at least once, in order to bring about physico-chemical contact between the particles of soils and the rootlets of

the plant. The plants have to be protected from being browsed over. If the leading shoot is browsed over 2 or 3 times a number of side shoots come off giving the plant a broom-stick-like appearance making it useless. A considerable number of *hebbe* plants (*i.e.*, plants with clods of clinging earth) dry up after transplanting if moisture is insufficient; even in the case of tile-pot plants a few vacancies occur which may be filled up immediately if the season should permit or in the next season. Provided that all conditions, *viz.*, soil, situation and rainfall are satisfactory the trees will grow to a girth of 2 to $2\frac{1}{2}$ feet within about 6 or 7 years and an acre of such trees may fetch a price of Rs. 250 to 350 according to demand. The side branches should not be pruned until after 4 years of planting and then they may be cut upto $\frac{1}{3}$ or $\frac{1}{4}$ the height of the tree from the bottom. The prunings will give a large quantity of small fuel. If pruned early, the saplings become thin and lanky and do not grow up into large healthy trees.

5. Habits of Casuarina and Its Reproduction.

It is a tree which grows more rapidly than many other species; a growth of two to ten feet in a year is not uncommon. Coppice shoots grow more rapidly than seedling plants.

Casuarina wood is a great producer of heat and corrodes the metals if burnt continuously in metallic ovens. It does not grow in shade. It does not allow any other kind of plant to grow in its shade. But honge and tamarind (*Pongamia glabra and Tamarindus indica*) can hold on although they suffer much. Curiously enough, sandal which is a parasite on casuarina and a shade lover, grows with it. Casuarina is a great lover of open air. It requires a soil free from thorns and shrubs, rosha and other tall grasses. If beds of hard gravel or stone exist underground the saplings die when the roots reach that bed. Being a fast grower it absorbs a very large quantity of water and it is therefore capable of drying up swamps. Consequently springs and wells in the neighbourhood will often dry up. It has also the property of reclaiming saline soils if planted in them. Fallen needles which form a fairly thick bed under the trees give a good covering all over the ground and generally no grass is found to grow under casuarina. The central leading shoot is much stronger than the branches and the rapid growth in height is due to it. If the leader is destroyed more than once the sapling becomes bushy

and useless. The wood, if seasoned under water for a month or two, lasts for 30 or 40 years and can safely be used for building purposes. The wood for buildings must not be tender and less than 7 to 8 years old. If exposed to moisture the wood rots away in a few years and should therefore be protected from getting wet. Casuarina wood is heavier than that of many other species. It is not a long living tree as are teak and many other kinds. In moist and favourable soils it will live for about 50 to 60 years. In dry situations its life is short, about 15 to 30 years.

Natural reproduction from seed is impossible in the plantation itself as nothing grows in its shade except a few very hardy species like tamarind and honge which can live against odds as mentioned above. Sandal can grow with casuarina in the same pit; hence the large number of casuarina-cum sandal plantations opened by Government at the close of 19th century. The sandal comes into the plantations in the following manner. Beginning with the nursery, tile-pots are set in nursery beds in pits about 1 inch deeper than the height of the tile and filled with earth as described above. Sandal seeds are sown 2 in each tile 2 months before casuarina seedling is transplanted in it. Sandal seed takes forty days to germinate and these seedlings will be 3-4 inches tall by the time casuarina is transplanted by its side.

Apart from planting, there is another and more important method of casuarina reproduction from growing trees. This was not known until recently and even now it is not known to many. Had this been known before, lakhs and lakhs of trees cut out in the Government plantations would have had their traces left even now. The tree is capable of layering. For this method, the lowest side branches upto 1 or 2 feet from the ground should be left uncut while pruning. When these branches are about 4 or 5 feet long, a shallow pit should be made in the ground under them and the branches bent into it and earth thrown on the bent portion. The branch forms roots at the spot. In course of time shoots appear from the spot after the branch is cut out from the original tree.

The tree is also reproduced from coppice shoots in red loamy soils and clay loams. The tree coppices if sufficiently young. Several shoots come up from the same stool. The coppice shoots grow up very rapidly, sometimes 10 to 12 in a year. At other times they may

not coppice for want of vitality, but the number of such failures is made up by two, four, five and sometimes ten shoots appearing from the stumps. Trees for coppice must be felled in the rainy reason.

Rural Economy in Mysore

BY

M. S. Ramachandra Rao, B.A., B.L.

Senior Assistant Commissioner in Charge of the State Huzur Treasury

I. The Peasants' Problems

Five-fold Foes of Rural Prosperity

Indebtedness the most Formidable

Inaccessibility, Insanitation, Ignorance, Inertia and Indebtedness are the five-fold foes of rural prosperity. Of these, indebtedness of poverty, although placed last is, perhaps, the most formidable. For, according to the economic survey of some villages in Mysore which have been carried out under the writer's personal supervision, it is found:—

(i) That more than 80 per cent of the rural population is indebted.

(ii) That the average debt per family which is the unit of economic existence, works out to about Rs. 200, and

(iii) That the rate of interest charged is rarely less than 12 per cent.

Causes of Rural Indebtedness

Various are the causes for this unsatisfactory state of things. Thus in the first place, on account of the uncertainty and unequal distribution of the rainfall not infrequently, the annual harvest is barely sufficient for subsistence. This is especially the case where the ryots' holdings consist exclusively of dry lands. Secondly, even if it is sufficient for this purpose, the surplus or margin available for conversion into cash by export or sale may be too small for meeting the cost of cultivation, Kandayam, and other recurring expenses. Thirdly, even if the produce is plentiful, the prices may go down and make it impossible for the ryot to meet these fixed and unalterable obligations which have to be satisfied in the form of *money and money only*, and that too from the profits of agriculture *alone* as things stand

at present. This will indeed be found to be the cause at bottom, of the world-wide economic depression through which we are passing. Fourthly, even if normal recurring expenses can be provided for somehow out of current agricultural revenue it will certainly be insufficient for defraying the cost of extraordinary items like marriages, etc. The combined result of all these circumstances is a constant inability on the part of the ryot to balance his budget and the consequent necessity for him to borrow again and again. Coming to the question of repayment, the rate of interest charged is so high that few ryots find it possible to pay even the interest regularly, not to speak of the principal. When repayment falls into arrears, and the creditor becomes importunate, and threatens with legal proceedings, there will be no other alternative for the debtor than to execute a fresh bond compounding both principal and interest either to the same or to a different creditor and at a much higher rate of interest. In this way the original debts are rarely discharged but go on swelling in volume and value from year to year, and descending from father to son, and from son to grandson and so on until as Mahatma Gandhi put it so aptly, the ryot has begun to think "penury is an inheritance from which he cannot shake himself free".

The Cure for the Same in General Terms

The question therefore naturally arises how are we to lift the ryot from this slough of despair and put heart into him ? In this connection it is interesting to note what Dr. Harold Mann than whom perhaps, few persons had better opportunities of appreciating the psychology of the peasants' mind, says in the course of an article which he contributed to one of the *Hindu Annuals* on this identical subject, under the caption " A View of Rural Development in India : Creating Hopes among Peasants". Says Dr. Mann :—

> " Movements which do not touch the villages and their people or which do not win their acceptance are almost certain to be a failure. If, on the other hand, they capture the imagination and kindle the enthusiasm of the peasant population, they are certain to be a success. And this is right.
>
> " I personally have a great admiration and belief in the rural inhabitants of India. Townspeople often adopt a patronising attitude towards the peasants, speak of them as " poor " cultivators, sigh over their supposed conservatism and relative

illiteracy and generally look upon them as backward and unenterprising. In an attitude of this kind, there is, I think, one part sense and nine parts nonsense. For, from my long experience, I am convinced they need no patronage, that in most cases, their conservatism is wise, and they readily adopt improvements within their power, and of the utility of which they are convinced, that though not able in most cases to read and write, many of them are as fully equipped for their job as most of their critics and that many of them are as enterprising as they dare to be. They are the raw material of a great nation—a raw material which if a favourable environment can be created, will form a solid body of a greater India of the future than has ever before existed.

"I would urge again the essential *fact* that *the advance of India means, if it means* anything, *the advance of the rural population*, that in them you have as fine a material as the world contains, and that *they are largely stagnant* on account of what they *consider the hopelessness of the situation* . . . The first step to rural improvement is the creation . . . *of hope in the minds of the peasants* . . . *that the whole of the advantage will not be reaped by the land-lords, the money-lenders and the like* . . . *but by themselves* . . . We have, in fact, to kindle hope in the minds of the peasant classes where it hardly exists now, *and all else will follow*. Agricultural improvement, education, sanitation, social improvement, gradual abandonment of evil customs, will all, I believe, follow the recreation of hope in the minds and hearts of the peasants of our villages."

Secondly, turning to the industrial field, some equally helpful and practical suggestions have been put forward by Mr. Henry Ford in his book "To-day and To-morrow", to the following effect:—

"For hundreds of years men have been talking about the lack of opportunity and the pressing need of dividing up things already in existence. Yet, *each year has seen some new idea brought forth and developed, and with it a whole new series of opportunities until to-day, we already have enough tested ideas which put into practice would take the world out of its sloughs and banish poverty by providing living for all who will work*. Only the outworn notions stand in the way of these new ideas. The world

shackles itself, blinds its eyes, and then wonders why it cannot run."

Coming nearer home, the same heartening ideas have been adumbrated by our Dewan (Sir Mirza Ismail) in his very first public utterance (address to the Representative Assembly in June 1926), in the course of which he says :—

"*The economic question stands first among all our questions* . . . Government will be ready to respond to any well-considered and practical suggestion for the encouragement of local enterprise . . .

"We have all felt the need for the extension of the avenues of employment . . . This is undoubtedly the *most pressing* and the most widely felt problem of to-day. But there is no royal road to its solution. Greater prosperity for which all should work, will cause a natural increase of employment.

"We deliberate amidst many difficulties, but *these merely accentuate the greatness of our opportunity.* We have a fortunate State, *fortunate in the ability and wisdom of its Ruler, in the character and homogeneity of its people, in its vast mineral and other resources almost untouched but ours to develop. Few lands are so ready to respond to effort, if the effort be wise and strong, and steady and united.*"

Thirdly, turning to the economic field, the following extracts from Mr. John Maynard Keynes' latest brochure *The Means to Prosperity* show what, according to this expert economist, is the nature of the problem and what is the solution he has to offer :—

"If our poverty were due to famine or earthquake or war —if we lacked material things and the resources to produce them, we could not expect to find the Means to Prosperity except in hard work, abstinence, and invention. In fact our predicament is notoriously of another kind. . . It is as though two motor-drivers meeting in the middle of a highway were unable to pass one another because neither knows the rule of the road. Their own muscles are no use, a motor engineer cannot help them; a better road would not serve. *Nothing is required and nothing will avail except a little, a very little clear thinking.*

"So too our problem is not a human problem of muscles and endurance. It is not an engineering problem or an

agricultural problem. It is not even a business problem . . . On the contrary it is, *in the strictest sense, an economic problem*, or to express it better as suggesting *a blend of economic theory with the art of statesmanship, a Problem of Political Economy.*

"I call attention to the *nature of the problem, because it points as to the nature of the remedy.* It is appropriate to the case that the *remedy* should be found in something which can fairly be called a device. Yet there are many who are suspicious of devices, and instinctively doubt their efficacy . . . . But the lorries of these people will never, I fear, get by . . . *unless they stop to think and work* out with the driver opposite *a small device* by which each moves simultaneously a little to his left."

The remedy or "device" which he has "thought," "worked out" and "found" is expressed in the formula, namely, "Immediate development of all capital resources with loan funds".

These views or suggestions have been reproduced at some length because of their appropriateness to the present occasion, summing up as they do in a nut-shell, not only the problems by which we are confronted but also their solutions. As will be shown in the succeeding articles they can be translated into practice with very beneficial results so far as Mysore is concerned by adopting the following specific measures:—

(i) Carrying out an Economic Survey and Economic Planning throughout the State.

(ii) Co-ordinating the functions and activities of Village Panchayats and Co-operative Societies.

(iii) Establishing a Co-operative Society as an adjunct of every Village Panchayat or group of Village Panchayats having an income of, say, Rs. 1,500 per annum.

(iv) Requiring such single, or group panchayat-cum-co-operative societies to employ an educated young man on a salary, say of Rs. 25 per mensem as the common secretary of all the unit panchayats and societies constituting the Federation.

(v) Liberalising the provisions of the Co-operative Land Mortgage Scheme of Relief, and extending it to every

nook and corner of the province by means of primary societies with unlimited liability.

(vi) Linking up the above Scheme with the Scheme of State Life Insurance Public Branch.

(vii) Inaugurating a large programme of irrigation and other productive works of public utility on a strictly capital and revenue basis.

(viii) Taking advantage of the present easiness of the money market, and floating a cash-loan to finance the above schemes unless the requisite funds can be found from the existing cash balances or investments or unless equally convenient accommodation can be obtained from the proposed Reserve Bank of India.

(ix) Placing an officer on special duty for some time to work out the practical details of the scheme in consultation with the authorities concerned, and thereafter, actually, to introduce it throughout the State after it shall have been approved by the Government.

The rationale and *modus operandi* of each of these proposals as well as the method and means of overcoming the other four foes of rural prosperity besides indebtedness will be discussed in the succeeding articles.

(*To be Continued.*)

Urine Hormone Injection for Stimulation of Fertility

BY

Lieut. A. A. Monteiro, G.B.V.C.
Live-Stock Expert

It is well known that stock owners in the State suffer considerable economic loss from pathological and functional disorders of the reproductive organs in their breeding stock. Environment, diet, mineral deficiencies, specially calcium and phosphorus, endocrine secretions, heredity and excessive sexual use all play a role singly or in a combined manner in producing sterility. Although a predisposition to sterility is a feature in certain families, environment associated with deficiencies in the soil and fodder is an

important factor in this country, where pastures are unenclosed and neglected and intensive farming of pastures is unknown. This leads to a defective nutrition of the stock.

Exact statistics regarding the incidence of sterility among our breeding stock is not available, but the annual loss to the stock owner and dairy farmer from this cause may safely be stated to be very heavy. It is a common sight in certain parts of the State, to see sterile cows being put to plough, as no other use could be found for them.

In western countries where intensive dairy farming is practised sterility among cows has been specially investigated, and the facts about the role played by the males are less familiar. Unless optimum conditions are fulfilled certainly sterility will result. Soundness of the generative organs and of the reproductive system in both sexes is equally important to create the optimum conditions.

It is quite common in the domesticated breeds in the State to find bulls that are either slow or absolutely refuse to function. Amritmahal breeding bulls supplied to the Village Panchayets with a view to effecting improvement in the village cattle were periodically inspected by officers of the Agricultural and Veterinary Departments. A few instances where the bulls were not satisfactory came to be noticed. It is usual for bulls of this breed to lose their mative inclinations for some time when they are removed from their surroundings. In some cases, the bulls which had rendered satisfactory service for some time had ceased to function.

The pioneer work of Zondek and Ascheim in 1927 upon the hormone contents of the urine of pregnant women and their subsequent demonstration of similar hormones in the urine of the cow, suggested the application of the technique to animals of economic importance. Later analysis of such hormones as contain the important constituents of certain glandular activities during pregnancy, led to the application of the technique in the treatment of sterility in both sexes, a sterility characterised by the disfunction of the sexual apparatus.

Kerr of Bengal was the first in India to attempt successfully the treatment of injecting Urine Hormones of pregnant cows into breeding bulls slow to cover and into sterile cows.

Technique

The material for injection is the prepared urine of a cow known to be in an advanced stage of pregnancy. The nearer the date of delivery the better.

The urine is caught as the cow passes it in a sterile enamel mug (quarter size), the first two or three ounces passed being discarded. The quantity required for one case is about 400 c.c. (say 12 ozs.)

To each 100 c.c. of urine 5 c.c. of a 20 per cent solution of Sulphosalicylic acid is added and shaken well for 10 minutes, to precipitate proteins. It is then passed through a coarse filter paper.

The urine is now acid in reaction and must be neutralised by adding a saturated solution of Sodii Bicarb until it is just alkaline to litmus. It is now faintly antiseptic also.

It is then poured into sterile 3 ozs. phials, preservative added, corked and sealed with paraffin wax. Each phial will contain about one dose, 100 c.c. This will keep potent for 4-5 months if kept in cold storage.

The following bulls were treated with urine hormone :—

1. Amrutmahal bull of the Village Panchayet of Bommahally, Arsikere Taluk, which had refused to cover since August 1933, was injected on 7th December 1933 and has since covered 20 cows upto March 1934. He had covered 40 cows before he had stopped functioning.

2. Amrutmahal bull of the Village Panchayet of Budigere, Devanahalli Taluk, which had ceased functioning since July 1933 was injected on 26th November 1933 and has since covered 26 cows upto March 1934. He had covered 200 cows before he had stopped functioning.

3. Amrutmahal bull of the Village Panchayet of Koppa, Anekal Taluk, which had covered 150 cows upto the end of June 1933 and had ceased to function was injected on 19th November 1933 and has since covered 8 cows.

4. Hallikar breeding bull of Babbur Farm aged 9 years which had ceased to function has covered 11 cows subsequent to the injection on 3rd October 1933.

5. Amrutmahal bull of Hebbal Farm which has not covered any cow for nearly two years was injected on 23rd August 1933 and 29th December 1933. He is still cow-shy.

6. Amrutmahal bull of the Village Panchayet of Togaranahally, Alur Taluk, which had not rendered any service since the date of supply, *i.e.*, 24th November 1932 was injected on 11th September 1933 and is reported to be covering.

From the foregoing, the effects of the treatment appear to be encouraging as all the bulls except No. 5 has responded to the treatment. It is yet too early to say if the effects of a single course of treatment will be permanent. However, these treated animals will be watched carefully and their performances recorded for further study.

The technical portion of the work was carried out by Mr. K. Ranganatha Rao, the Research Assistant to the Superintendent, Civil Veterinary Department.

Botany of Groundnut

V. K. Badami, L.Ag., Ph.D. (Cantab.)

Groundnut has many other names in English language, *viz*, earth nut, pea nut and monkey nut. There are other plants which bear names similar to groundnut and may be mistaken for it sometimes. Pig nut, *Bunium esculentum*, is a slender umbelliferous plant which occurs wild in Great Britain. It bears umbels of white flowers in early summer. The root is similar to potatoes and is sometimes eaten as food. Another wild bean or groundnut is common in North America, *Apios tuberosa*. It is a climbing plant growing 6 to 8 feet. In summer it bears clusters of fragrant purplish flowers. It bears flat linear pods and the tubers are boiled and eaten as food like potatoes. *A. fortunei* is a Japanese species having edible tubers. Roots of the dwarf ginseng *Aralia trifolia*, are also known as groundnut.

Trifolium subterraneum, a clover, buries its nuts in the ground and the plant is considered to be a good fodder for animals. Voandzia or Bambara nut of West Africa also buries its pods underground. *Commelina bengalensis* is another plant in India which buries its seeds underground. In this case special underground stems are formed. They bear flowers and set seed below the surface of the ground. These underground stems behave exactly like the

gynophores of groundnut in regard to geotropic action. This plant is also amphicarpous, producing often flowers and seeds on aerial stems.

The habit of developing the pods underground is not therefore peculiar to groundnut alone. It is not exactly known how the other species of *Arachis* found in Brazil develop their pods. The habit of the plants and the fact that no one has yet collected seeds of those plants, strongly suggest that they may also develop their pods like groundnut.

The systematic position of groundnut and its relation to other plants has not been finally settled. It is classed amongst papilionaceous plants of the legumes in the tribe *Hedysareæ*. Linnaeus placed it next to *Cicer*, Pearson nearer to *Anthyllis*, Jussieus between *Ononis* and *Anthyllis*. De Candolles taking the character of the embryo placed it among the *Geoffræa* but noted that in all other respects *Arachis* was quite different from these plants. He suggested the grouping together of *Arachis* and *Voandzia* as a distinct tribe. Brown observed that *Arachis* and *Cercis* possess straight embryos in common with the Cisalpineæ and Mimoseæ, in which respect they differ from the Papilionaceæ.[1] Roxburgh[2] placed it nearer to *Stylosanthus*. The flower of the plant is papilionaceous and its general appearance and habit also are like the plants of this subfamily, but the presence of a large number of tannin sacks and the straight radical in the embryo are like those to be found in the subfamily Cæsalpinioideæ. The solitary rhomboidal crystals of calcium oxalate are like those of the Papilionaceæ. They are found accompanying the veins in the epidermis of the leaf and are enclosed in the thickening of the cell wall. Ordinary unicellular hairs, present in Cæsalpinioideæ are absent, but have the usual trichomes found in Papilionaceæ.

In Flora Brasiliensis, *Arachis* is placed between *Zornia* and *Stylosanthus*.

Engler places *Arachis* after *Stylosanthus* and before *Desmodium* and refers to 9 species in Brazil.[3] He places Voandzeia after Vigna in Phaseolus. Dr. Richard Wettstein[4] places the position of *Arachis* as follows :—

---

1 E. L. Reed, "*Arachis hypogæa*," *Bot. Gaz.*, Vol. 78, Nov. 1924.

2 Roxburgh, *Flora of India*, Vol. III, p. 281, 1832 edition.

3 Engler-Gilz, *Syllabus der Pflanzen familien*, pp. 241–249.

4 Dr. Richard Wettstein, *Systematischen Botanik*, Leipzig und Wien, 1924.

I Class—Dicotyledons.
Sub-class—Choripetalæ.
22nd order—*Rosales.*
13th Family—Papilionaceæ.
Sub-family—B. Papilionatæ.
No. 9 Coronilleæ.
Sp.=Arachis hypogæa.
It is placed between *Aeschynomena Elaphroxylon* and *Lespedeza bicolor.*

The following species in *Arachis* are now well known:—

(1) *Arachis hypogæa* is an annual, cultivated plant now grown all over the tropical and many sub-tropical countries as a commercial crop of great importance.

The following related species are all found in South America in Brazil:

(2) *Arachis pussilla*, Benth.—This is found in Serra, Jacobina, Brazil, frequently in shady places from Bijogrande to the town of Ociras. It is an annual. Stem is slightly erect. The lateral branches are hairy and prostrate. The small leaves are membranous, smooth or slightly hairy. Flowers are smaller than *Arachis hypogæa* but the calyx tubes are longer.

(3) *Arachis prostrata*, Benth.—This is a perennial prostrate plant with hairy stem. In Brazil it is fairly common on the river side of Parnahiba in the Province of Maragnana and in the grazing fields of upper Pianbic, on the mountains near Rio de Janeiro. Gaudichand found it near Cuyaba in sub-humid and shady places. Reidel found it in the province of Gagaze. The leaves of this plant are small and the calyx tube is longer than in *A. pussilla*, sometimes almost 3 inches.

(4) *Arachis villosa*, Benth.—This is a perennial prostrate hairy plant, closely related to *A. prostrata*. It is found in Southern Brazil in the province of Rio Grande and in Uruguay in the sands and streams of rivers.

(5) *Arachis glabrata*, Benth.—This is a perennial plant, prostrate or ascending, with smooth or sparsely hairy stem. It is found in Brazil near Rio Pardo and in the marshes at Cuyaba. St. Hilaire found it near Raibeiro Corrinte in the province of S. Pauli.

(6) *Arachis marginata*, Gardner.—This is a perennial plant with thick, leathery, marginated leaf. It is found in the higher regions near Missione Duro, province Goyaze, and in sub-humid places in the regions near Carriapace near Rio Pardo. St. Hillaire found this in South Brazil and a smooth variety, in the province of Rio Grande.

(7) *Arachis tuberosa*, Bong.—This is a perennial plant with a thick, woody rhizome. The stem is short and there are three oblong leaflets. All flowers at the nodes are sub-radicle. It is found in Camapul by Rio Pardo in South Brazil.

Generally, one species of *Arachis hypogæa* is recognized. Attempts have been made to separate "Bunched" or "erect stem" and "running" or "prostrate" stem into two different groups. Prof. Dr. Hubert Winkler in *Botanisches Hilfsbuch* classifies *Arachis hypogæa* into two classes.

1. *A. africana*, a prostrate glabrous form, and 2. *A. asiatica*, an erect, hairy form. Similar attempts have been made by others with different names. Professor Baldrati[5] made the following statement in 1907: "It is generally admitted that all the types cultivated belong to the same species, nevertheless two years ago the *Boletin de agricultura* of St. Paulo in Brazil gave precise description of the cultivation of a species different from that of hypogæa." It is possible that a search in Brazil may yet reveal fresh knowledge about this plant which is shrouded in mystery. A new species *Arachis nambyquara*[6] was discovered by Prof. F. C. Hochene of the Roudan Commission exploration party. It was found cultivated by the Nambyquara Indians in the interior of the state San Paulo in Brazil. Descriptions of this have been given already in Part I. Through the courtesy of the Department of Agriculture, U.S.A., samples of this have been received and grown successfully at Bangalore.

Groundnut is a dry indehiscent fruit. The pericarp is the dry shell. In most of the varieties there are only two or three seeds.

---

[5] Prof. I. Baldrati, *L'Agricultura Coloniale* (Rome), No. 2, 1907.

[6] *International Review of the Science and Practice of Agriculture*, 24, 5 *Tropical Agriculture*. (Lobbe H. *Amendoim dos Nambyquaras*, *ceres*, Year II, No. 2, San Paulo, 1926, page 56, Vol. 18, New Series, Feb. 1927, No. 1.)

The seeds are free in the dry shell. They are exalbuminous. The coloured seed coat is the testa or the developed integuments. The perisperm is a thin whitish layer inside adhering closely to the testa. Cotyledons are swollen and filled with oil drops, proteids and starch granules. The embryo is fairly well developed, consisting of a central bud with one or two developed compound leaves and two lateral buds of a similar development. The radicle consists of a thick hypocotyl, slightly projecting outside. The seed does not require any resting stage. As soon as it is ripe, if there is any moisture in the soil it sprouts. Some people maintain that there is a period of dormancy and the character of sprouting early with smaller period of dormancy is heritable. But I feel that it is only a question of early ripening and sufficient driage of seeds that are essential for rapid germination. The seed absorbs nearly its own weight of water and germinates in from 24 hours to 72 hours in an incubator at a temperature of 25° C. After the thick fleshy hypocotyl has grown to about half an inch it tapers down and the main tap root continues to grow. The lateral roots are formed very early in the form of a tetrarch. Meanwhile the cotyledons open out and the central bud grows vigorously and expands into a compound leaf with four leaflets. The cotyledons, if exposed to light, turn green and persist for a long time, shrivel up but rarely fall.

Stem.

If the seeds are sown about 2½ inches in the soil it takes 10 or 15 days for the shoots to appear above the surface. When the central shoot has grown 2 or 3 inches high the two lateral branches start growing. In a spreading variety they creep along the surface of the ground but in an erect variety they grow upright like the central stem. Very soon two more lateral branches develop and they grow more or less at right angles to the first two. Thus the appearance of a plant at this stage is that of a cross in spreading varieties. Further development is rapid. Secondary branches begin to develop from the two or three lowest buds from every branch. Growth of secondary branches in all directions covers the ground. In the erect variety all the secondary branches also grow erect and to the same height as the central stem. This development gives it a bushy appearance. Later the weight of the foliage on the delicate branches

makes them bend towards the ground. In a heavy growth even the erect plants assume a procumbent habit. In late types the lateral branches in spreading varieties continue to grow for a long time whereas in early ones they stop after a definite period of growth.

Growing points and the delicate shoots are covered by the sheath of broad long bifurcated stipules. The stem is hairy with well-developed shaggy hairs. The internodes are angular but turn rounder with age. Generally they are slightly compressed. In older branches the stem gets smooth. The stem is herbaceous with a pithy core. A cross-section reveals the presence of cells containing tannin below the vascular bundles. In almost every place, just at the base of a vascular bundle, two or three large cells filled with tannin are present. The cambium layer is very vigorous. Wounds are easily healed and the plant can be easily propagated by cuttings, layers, approach grafting or cleft grafting in a hot house. Advantages of this observation will be shown later. At the base the stems are about 4 mm. to 8 mm. in diameter. The average thickness may be taken as about 4 mm. The lateral branches in spreading varieties grow out 12 to 18 inches long. The internodes are longer in shady moist places, but shortened in open dry fields, and they vary from 10 cm. to 40 cm. Generally they are shorter near the base of the branch.

Root.

The plant develops a vigorous tap root system. The tap root tapers down to a string and penetrates to a depth of 20 to 24 inches.

The root system consists of a tap root and lateral feeding roots :

(1) The tap root grows long and penetrates the subsoil. It taps the subsoil moisture to enable the plant to live during droughts. In specimens collected in Madagascar and parts of America and South Africa it was seen that a woody stock had been formed. Probably, the plants had lived for several seasons and passed through several droughts. Similar characteristics may be observed in specimens of allied species collected in Brazil.

(2) The second system is the surface or feeding roots similar to that of cotton. They develop in masses two or three inches below the surface of the soil in all directions, specially in well cultivated soils. They are numerous and are developed in the ploughed layers of the subsoil.

The number of nodules on the roots is numerous and the plant gathers a large quantity of atmospheric nitrogen. In new tracts where the crop was not grown before there was some difficulty in growing groundnut plants. This was the case on the Government Farms on the West Coast of India. An application of the soil brought from the groundnut area in the eastern districts set right this defect and successful crops have now been harvested.

In trying to grow groundnut at Cambridge, I soon found that the plants were not vigorous and on examination, discovered that the bacterial nodules were absent. This was the case both with the plants grown on the University Farm and in the tropical-pit of the Botanical Gardens. A parcel of the soil was secured from Hebbal, India. Portions of this soil were mixed with the pot soil but had no effect. Attempt was made to grow the plant in the imported soil. The plant grew sickly and developed no nodules. Probably the soil had got too dry and heated up in the sun before it was packed and had no living bacteria or spores when it arrived here. On the other hand, all the plants made a tolerably good growth in the rich potting soil and flower beds in the Botanical Gardens. Burying the shell along with the seeds had some effect. A dozen or two small nodules and one or two big ones were produced on the roots. Reburying these nodules in the soil had no effect in developing this particular bacterium in the soil. On the other hand, all other legumes grown along side of *Arachis* on the University Farm were healthy and had bacterial nodules in plenty.

(*To be Continued.*)

DEPARTMENT OF AGRICULTURE, MYSORE STATE.

Programme of Experimental Work for 1935.

CIRCULAR.*

The Department of Agriculture desires to arrange with members of the Mysore Agricultural and Experimental Union for the carrying out of the experiments mentioned below. Members intending to undertake experimental work are requested to apply to the Secretary, through the Agricultural Inspector of their range, before the 15th February 1935 marking out on this circular the experiment or experiments they desire to undertake. The seed, manure, etc., will be supplied in the order in which the application is received as long as the stock lasts.

1.—Experiments with Seeds.

Trial of selected strains of—

(*a*) Ragi—seed enough for 3 guntas each of two new varieties will be supplied.

(*b*) Groundnut—seed enough for 3 guntas each of one or two new varieties will be supplied.

(*c*) Cotton:

(1) Doddahatti—seed enough for 3 guntas will be supplied.

(2) Sannahatti—seed enough for 12 guntas each of two varieties will be supplied. (Trials confined to cotton areas only.)

(*d*) Paddy—seed enough for 3 guntas each of two varieties will be supplied.

(*e*) Sugarcane—seed enough for one gunta each of two Hebbal seedling canes will be supplied. Arrangements for the conveyance of seed setts from the nearest railway station should be made by the member indenting for them. Applications for sugarcane setts should be made so as to reach the Secretary before the 15th February 1935 stating the probable time the setts should be supplied and the Railway Station to which they should be sent.

* Copies of this circular have been distributed among members.

Conditions of Supply of Seed.

1. The seed of each variety shall be sown in separate plots with check plots arranged as per instructions sent with the seed.
2. The results of experiments shall be reported after harvest in the form which will be supplied.
3. The experiments shall be conducted continuously for at least three years, seeds for the second and subsequent sowings being reserved from the first supply by the Agricultural Department.

2.—Experiments with Manures.

I. *Sugarcane.*—Comparative trial of 100 lbs. of ammonium sulphate and 3 cwts. of superphosphate per acre applied before planting and 240 lbs. of ammonium sulphate 6–8 weeks after planting and 1 ton of groundnut cake applied again 3 months after planting, against—

(*a*) 3 cwts. of super and 200 lbs. of ammonium sulphate before planting; 400 lbs. of ammonium sulphate 6–8 weeks after planting and again 15 cwts. of groundnut cake 3 months after planting, *or*

(*b*) Same as (*a*), but with only 10 cwts. of cake.

II. *Paddy.*—Trial of 80 lbs. of sulphate of ammonia and 150 lbs. of superphosphate per acre, against—

(*a*) 60 lbs. Nicifos 17/45 grade + 100 lbs. of groundnut cake,

or

(*b*) 120 lbs. of Nicifos 22/18 grade.

Not less than 10 guntas of land will be required in each case.

3.—Areca.

Trial of a mixture of 400 lbs. groundnut cake, 100 lbs. concentrated super and 120 lbs. muriate of potash per acre of 400 bearing trees against—

(*a*) 160 lbs. sulphate of ammonia, 100 lbs. concentrated super and 120 lbs. muriate of potash, *or*

(*b*) 200 lbs. Nicifos 22/18 grade and 120 lbs. muriate of potash, *or*

(*c*) 150 lbs. Nicifos 17/45 grade and 120 lbs. muriate of potash.

A minimum of 180 bearing plants are required for the purpose.

The manures required for all the trials will have to be purchased by the member.

4.—Experiments on the Control of Insect Pests.

(*a*) Sugarcane Borer
(*b*) Pests of Stored Pulses
(*c*) Pests of Stored Paddy
(*d*) Coffee Borer
(*e*) Lime-tree Borer
(*f*) Avare Pod Borer.

} Printed instructions will be sent on requisition.

5.—Experiments on the Control of Fungus Diseases.

(*a*) Treatment against Smut on Jola.
(*b*) Spraying against *alternaria* disease of potato.
(*c*) Spraying against Chrysanthemum Rust.
(*d*) Spraying against downy mildew of grape vine.
(*e*) Experiments on eradication of seegade satte in paddy fields.

BANGALORE,
4—1—1935.

B. NARASIMHA IYENGAR,
Offg. Director.

DEAR SIR,

I desire to undertake the experiments ticked off on the circular during the coming season. I have conducted the experiments undertaken by me last year properly. I agree to conduct the experiments and report results as required during the present year. Please arrange to supply the requirements.

Station.....
Date.....

Yours faithfully,

Signature and Address of the Member.

SELECTIONS

Chemical Composition of the Mango

The chemical composition of the fresh pulp of mango fruit has been determined by R. Yamato, Y. Osima and T. Goma (Tokyo Institute, *Scientific Papers*, 1932, Vol. 19, p. 122), who have reported the following data. The water content of the pulp is 81.7 per cent, and the sugars consist of sucrose (5.5), fructose (4.9) and glucose (1.5). The acid taste is due to citric acid (0.5), and the yellow colour, to xanthophyll (0.9) and carotene (0.1). The last-named substance, isolated from mango fruits, was found to cure avitaminosis-A in rats, and therefore confers a valuable food property on fruits.—*The Madras Agricultural Journal*, Vol. XXII, No. 7.

Record Yield of Sugarcane in Hawaii

What is claimed to be the world's record sugar production is reported from Hawaii, where in the plantation of the Hawaiian Sugar Company, in Kauai, a patch of nine acres averaged 186 tons of cane per acre, yielding slightly over 21 tons of commercial raw sugar per acre, or just under nine tons of cane to one of sugar. The variety grown was H. 109. The patch was part of a field that had been fallowed for a number of years. Besides this, the same company harvested two other fields in the same area which averaged 137 tons of cane, yielding more than 16 tons of sugar; these were planted with H. 109 and POJ 2878.—*The Journal of the Jamaica Agricultural Society*, Vol. XXXVIII, No. 6.

Xylamon—A New Specific for Preserving Wood from Insect Attacks

A report on xylamon, a German preparation of chlorinated hydrocarbons, which is stated to be so efficacious in the destruction or prevention of all wood-boring insects and wood-destroying fungi including dry rot that its use "will bring about a complete revolution in the extensive and many-sided work of the protection of wood." This article first recounts the successes claimed for the preparation in Europe in combating well-established death watch beetle and dry rot, *e.g.*, in the roof timber of the cathedral at Bonn, and then proceeds to describe its effects on pests in the tropics, a problem which had not previously been investigated. It was found completely successful with both deep and surface borers and, more important still, with the destructive termite *Cryptotermes domesticus* whose hidden activities, generally directed

against furniture and house timber, often remain unsuspected until the collapse of the article attacked. The preparation can be applied by painting, spraying, or dipping; it is harmless to man or animals, and its preservative effects are permanent. It is insoluble in water and can therefore be used with under-water constructions. It takes paint readily and in a very short time after application. The manufacturers are Consolidierte Alkaliwerke, Westregeln, Magdeburg, Germany.—[*Horticultural Abstracts*, Vol. IV, No. 2.]

Security for the Individual

Among our objectives I place the security of the men, women and children of the nation first.....

This security for the individual and for the family concerns itself primarily with three factors. People want decent homes to live in; they want to locate them where they can engage in productive work; and they want some safeguard against misfortunes which cannot be wholly eliminated in this man-made world of ours.....

Security was attained in the earlier days through the interdependence of members of families upon each other and of the families within a small community upon each other. The complexities of great communities and of organized industry make less real these simple means of security. Therefore, we are compelled to employ the active interest of the nation as a whole through government in order to encourage a greater security for each individual who composes it.....

This seeking for a great measure of welfare and happiness does not indicate a change in values. It is rather a return to values lost in the course of our economic development and expansion.....

We must dedicate ourselves anew to a recovery of the old and sacred possessive rights for which mankind has constantly struggled—homes, livelihood and individual security. The road to these values is the way of progress.—Franklin D. Roosevelt. *Agricultural Adjustment Administration Report*, United States Department of Agriculture.

Grafted Coffee

While experiment is in its initial stage, many planters are now giving thought to producing a new type of coffee—Arabica grafted on a Robusta stem.

The chief reasons for entering on this experiment are to combat the white stem borer pest and *Hemileia vastatrix*, and it has been found

that Robusta stems are free from borer while almost immune from *Hemileia*.

That the grafted tree will produce a heavier crop is not seriously doubted, and that it will provide better type of coffee is anticipated, since all grafted fruits are an improvement.

All local experiments are recent and perhaps more advanced at the Agricultural Research Station, but so keen are most planters that they are not waiting for ultimate results before experimenting on their own initiative.

Some planters are still sceptical, however, regarding the success of the graftings, but once the method is thoroughly understood, it should be ninety per cent successful.

A local nursery-man has been experimenting for some time and successfully grafted trees can be seen.

It is anticipated that a fully grown grafted tree will have a Robusta stem 18 inches to 2 feet above ground and that Robusta sap, permeating the rest of the stem, will render the tree much less liable to borer infestation, and that much of the immunity enjoyed by the Robusta, as regards fungous diseases, and at least some of the insect pests, will be imparted to the graft.

Whether the graft will develop into a much larger tree than the usual Arabica species remains to be seen, but it is anticipated that the more robust root systems of the Robusta stock will be reflected in a larger spread of the top with consequent increase in bearing surface.—*The Tropical Agriculturist*, Vol. LXXXI, No. 4.

Determination of Live-Weight of Cattle by Measurement

BY

Sodhi Gambhir Singh, B.Sc. (Agri.), C.D.D. (Glas.), N.D.D.

Punjab Agricultural College, Lyallpur

Introduction

The importance of feeding animals scientifically is being everywhere gradually realized from the point of efficiency and economy. Overfeeding is wasteful, under-feeding undermines the health of the cattle. The science of feeding has evolved feeding standards for the guidance of farmers to feed their animals on scientific principles. The size of an animal has to be considered while estimating its maintenance ration. It has been found by experience that for all practical purposes weight of an animal can be made use of in place of its size in computing its maintenance ration. But to weigh animals it requires costly weighing

machines, which are not within the reach of an average Indian farmer wishing to feed his animals in a rational manner. Therefore a simple formula for arriving at the approximate weight of the animals can be of immense use.

Scope

There are certain formulæ, which are used in Western countries for estimating the weight of animals from certain body measurements. These formulæ were actually tried while teaching animal husbandry to the students of the Punjab Agricultural College, Lyallpur, but none of them were applicable to Punjáb cattle. A formula has recently been suggested by Capt. C. E. Macguckin, for this purpose. This formula was found to be the best of all of those at present known. It is given below:—

$\text{Girth}^2 \times \text{Length} \times 5.5 = \text{Live-weight of the animal in lbs.}$ In this formula girth and length are measured in feet. In actual practice this formula was found to work fairly well in the case of large animals, but it did not give satisfactory results for small cows of the Montgomery breed, which is the leading milch breed of the Province. This leads the writer to devise a new formula more applicable to small cows of the breed referred to above.

Method

Cattle of three different breeds commonly met with in the Punjab were examined during the period of investigation. Measurements and weights of 114 animals in all were taken. The measurements included the girth and the length of the body. Length represented the distance between the square of the buttock and the square of the shoulder. The readings for length were taken from both sides and averaged to eliminate the effect of different postures assumed by the animals at the time of measuring. The girth was measured just behind the shoulders to represent the circumference of the body.

The actual weights of the animals were taken on a weighing machine. From these data the value of X used in the new formula was determined as follows:—

Girth of the animal in inches was multiplied by its length in inches to find out the curved surface area of its body. The curved surface area thus ascertained was divided by its actual weight to arrive at the number of square inches of curved surface area required to give one seer of live-weight (40 seers=82 2/7 lbs.). This number was determined for animals of different girths and has been represented as X in the formula.

The formula in its final form is given below :—

$\frac{G \times L}{X}$ =Live-weight of the animal in seers.

G =Girth of the animal in inches.

L =Length of the animal in inches.

X =9 when girth of the animal is below 65 inches.

=8.5 ,, ,, between 65 and 80 inches.

=8 ,, ,, above 80 inches.

Example.—The girth of a cow of the Montgomery breed was found to be 64 inches and her length 52 inches; weight according to new formula was $\frac{64 \times 52}{9}$ =369.7 seers. The actual weight of this cow on the weighing machine was 370 seers.

This formula was tested against the one suggested by Capt. Macguckin on 114 animals in the College estate. A summary is given below :—

Breed	Average actual weight in lbs.	Average variation of the estimated weight from the actual weight expressed as a percentage of the latter	
		Formula I*	Formula II*
		Per cent.	Per cent.
Hissar Bullocks ..	1,100	1.28	3.17
Montgomery Cows ..	770	1.70	12.66
Dhanni Bullocks ..	1,000	1.56	3.30

* Formula I :—Evolved at the Punjab Agricultural College, Lyallpur.
Formula II :—Recommended by Capt. Macguckin.

Average variation has been worked out by adding together all the differences between estimated weights and actual weights of animals disregarding their signs (*plus* or *minus*).

From the figures quoted above it will be clear that the new formula (Formula No. I) gives better results in all cases particularly for small cows of the Montgomery breed for which the other is not suited.

(Figure and tables showing the details of the results are omitted.)

—*Agriculture and Live-Stock in India*, Vol. III, Part 2.

Vernalization

NOTE.—*Vernalization is a subject that has attracted much attention recently in the literature of agricultural science, and the claims made for it as a technical advance are so strong that some account of the process and underlying principles should be of interest to many agriculturists. The work has hitherto been concerned with the conditions and needs of temperate agriculture, but it is not improbable, if the theories there elaborated are confirmed, that complementary applications will be possible in the tropics. The original papers on vernalization are in Russian, but a review of the principles underlying the process was published by A. A. Sapelin in* 1932 *in "Der Zuchter", a German publication devoted to breeding. The Imperial Bureau of Plant Genetics has recently issued a summarized account of the experimental work in English. The sources have been freely used in the following note.*

The phenomenon of photoperiodism in plants, first investigated by Garner and Allard about fourteen years ago, is by this time widely recognized. Experience has shown that certain plants such as the cereals, oats and wheat, beet and onion require a length of day above a critical period of about 14 hours before they will go into the reproductive phase while other plants, such as maize, soybean, yam and sweet potato under similar conditions remain in the vegetative phase and only fruit when the length of day is below the critical period. This naturally led to the belief that fruiting was in some unknown way dependent on the diurnal alternation of light and dark.

From recent investigations the staff of the Ukrainian Institute for Genetics and Plant Breeding at Odessa hold that this belief is not correct and that there is no necessity for photoperiodism to ensure fruiting. Lyssenko, with whose name the new process is chiefly connected, states that "Photoperiodism exists, but not in the nature of plants so much as in the nature of the regions where there occurs the daily alternation of day and night." They claim to have shown that "the time necessary for the completion of the processes conditioning reproduction of the plant is independent of its size and age, but is primarily determined by its genotypical peculiarities and by its environment. Thus whether a plant is in the state of a germinating seed in which the seed coat is not yet broken or whether it is already well-developed vegetatively the transition to the reproductive stage requires the influence of the same factors acting for the same time. In other words: the processes determining the change from the vegetative to the reproductive phase in plants, may occur not only in the growing plant, but also in the germinating seed."

The transition to the reproductive stage is not only independent of the size and age of the plant but also has no connection with the growth of the plant. The two processes of growth and reproduction may take place independently of one another but under suitable external conditions both may occur simultaneously. The fact that the process of preparation of a plant towards reproduction may occur in the embryo and may be separated in time from the growth of the plant makes possible the practical application of the method. The Russian term for the process is "Jarovizatzia", which has recently been translated into English as "Vernalization". By its application seed can be treated so that it will produce plants fruiting at a pre-determined time. The process has been aptly described as "early sowing which is carried out in the granary". Seed is germinated and growth is artificially stopped before it has reached a stage at which subsequent handling might be detrimental to it. The material is then subjected to appropriate conditions for affecting reproduction, after which it is sown.

The appropriate conditions vary widely and must be determined experimentally, not only for each species but also for each variety of a single species, to obtain the best results. For wheat, vernalization is obtained by keeping the germinated seed with a moisture content of 50 per cent at a temperature of 3°C. for twelve to fifteen days. For tropical short day crops such as maize and soybean, vernalization is obtained by keeping the germinated seed at about 25°C. for ten to fifteen days in complete darkness.

The method had been most carefully worked out in Russia for spring wheats such as are grown on the Ukrainian Steppes. The chief characteristic of such wheats is their early flowering which is essential if they are to withstand damage by high summer temperature. Vernalization has enabled varieties which normally bear too late to set any crop to be grown, in some cases with a considerably greater yield than the standard varieties. Last year vernalization trials were carried out at Odessa on 6,300 samples of wheats.

Vernalization of the short day sub-tropical and tropical plants has not yet been investigated so thoroughly as that of the wheats. It has been found that darkness, humidity, temperature and æration must all be controlled. The degree of moisture of the germinated seedlings requires careful attention during the process or otherwise growth proceeds so rapidly that the over-grown seeds cannot be sown. Plants from vernalized seed can be grown under any condition of illumination. Their ability to utilize longer periods of daylight is advantageous in that an

increased production of dry matter becomes possible in addition to the acceleration of reproduction.

Many important commercial crops depend on tuber formation and attempts have been made to apply the principle of vernalization to such crops as exemplified by the potato. Long days favour vegetative development and flowering while short days favour tuber formation in the potato. Lyssenko's explanation of this is that short day tuber formation is due to the inability of the plant to utilize photosynthetic products for continued vegetative development and flowering and the consequent diversion of such products to storage organs. Under long-day conditions these products are utilized for development and flowering, but when fruiting is completed, the plant continues to assimilate and to use the products of assimilation for tuber formation. To increase tuber formation it is therefore necessary to get the fruiting cycle over as quickly as possible. This stage can be aided by exposing the tubers to light before planting. Under the appropriate conditions of temperature and humidity, tubers can be kept in continuous light for 20 to 30 days without growth becoming so active as to endanger the young shoots during planting.

The fundamental idea underlying vernalization is that the processes of growth, by which is meant gain in weight and size, and of development, or the transition from one phase to another, are two distinct phenomena taking place independently of but not necessarily antagonistic to, one another. The processes determining the change from the vegetative to the reproductive phase may take place at any time during the life of the plant, even in the germinated seed. Vernalization is in effect "the elimination of the effect of natural geographical and climatic factors limiting the introduction into field cultivation of any desired plant."

The process is too new as yet to give any result of its commercial application. That it will enable heavier yielding wheats to be grown on the Ukrainian Steppes seems certain. It is also being applied to forage crops, where it enables an earlier first cut to be obtained. The chief function of the process, according to Lyssenko, is the speeding up of plant breeding. Meanwhile, until successful new varieties have been introduced, vernalization is expected to be directly and chiefly responsible for increased yields.—*Tropical Agriculture*, Vol. XI, No. 1.

Disease Resistance in Plants

By L. R. Jones

Professor of Plant Pathology, University of Wisconsin.

In the address that I delivered before the Los Banos Biological Club last evening I called attention to the importance of plants as experimental subjects, touching on the cell theory and the discovery of protoplasm. I also spoke of the work of the German mycologist, Anton de Bary, on the causal relation of fungi to disease in plants. I discussed the researches of the Russian botanist, Wornin, on cellular pathology; that is, the interaction between the cytoplasm of the host and the cytoplasm of the parasite. In discussing the parasitism and disease in plants I mentioned the importance of the fungi as causal agents of plant maladies and that these were later on followed by the bacteria; also, that the virus diseases are becoming increasingly important as studies on them are being made.

For a proper understanding of disease in plants it is necessary to know what a normal plant is. A plant in health is in a state of equilibrium inside with outside conditions. Diseases cause a disturbance of the equilibrium in nature.

Biological Equilibrium

In nature, plant and animal life are in a state of equilibrium. The predominance of one over the other disturbs this equilibrium. As examples of this disturbed equilibrium may be mentioned the following: In Australia, a species of cactus was introduced as a pot plant. Later, the plant escaped cultivation and was increasing so prodigiously that it threatened to cover the land with impenetrable spiny-plant covering. To control the very rapid spread of the cactus it was necessary to introduce into Australia the following enemies of the cactus: (1) A caterpillar which bores tunnels through the plant; (2) a plant bug; (3) a cochineal insect which sucks the juice of the plant; and (4) a mite which scratches surface of the plant.

In Hawaii the sugarcane industry was threatened with destruction by weevils and the use of parasites saved the industry. The introduction into Hawaii of the Minah bird for combating insect pests for the sugarcane; the work in the Philippines of the entomologists of the Hawaiian Sugar Planters' Association to secure parasites of insects attacking sugarcane in Hawaii are instances of activities to restore disturbed equilibrium. Other instances which may be mentioned are the control in Kenya Colony of the mealy bugs of coffee with the use of the lady-bird and the control with a parasitic fly of the cocoanut moth, whose caterpillar destroyed

the leaves of the palms in the Fiji Islands. In plant pathology, equilibrium has a different biological basis from that with insects and parasites.

In the introduction of a new crop in a new country at least three easily definable factors are involved.

(1) Adaptation of the crop plant to the new environment.

(2) Presence of potential new parasites.

(3) Relative susceptibility or resistance of plant to parasites.

A knowledge of these factors is very important especially in new cultures in the Philippines.

Disease Resistance

The control of plant diseases by the production of highly resistant varieties, strains or individuals through breeding and selection consists of changing the nature of the plant in such a way that it is no longer susceptible to a given disease or pathogen. The production of resistant plants will probably be the ultimate solution of plant-disease control problems.

Disease resistance is not a new idea with us. The work on disease resistance at Wisconsin has been done by members of the staff, especially Dr. J. C. Walker and students.

Illustrations of disease resistance may be seen from the history of plant pathology in Europe and America. Take grape diseases and European grapes *versus* American grapes. There are many varieties of these grapes and they have many parasites. A universal resistance to destruction occurs among these grapes.

A generation ago, American grapes were introduced into Europe because the American roots are resistant to *Phylloxera*. In Europe the American grape was almost completely wiped out by the downy mildew, and only the discovery of Bordeaux mixture saved the industry. Now in Europe the use of spray for the control of the mildew is widespread. It is possible to get resistant vines by hybridization but because spraying is practical the work for production of resistant plants has never been finished.

European potato breeding obtained relative resistance which could be maintained by skilful attention to source of seed and cultivation of the plants in the field. Unlike the work on grape mildew no spray that offers better advantages for the control of the disease than by breeding resistant plants is used in potato.

Breeding for Disease Resistance in the United States

Norton in 1913 published the results of his work on breeding asparagus for resistance against the rust, *Puccinia asparagi* DC. The occurrence of the rust on asparagus in the United States was discovered in 1896,

About 1902 the disease was prevalent and destructive wherever asparagus was grown. As different strains varied in their susceptibility to the rust, breeding was started as a means of controlling the disease. Norton's work showed that structural differences were the cause of resistance to rust in the asparagus and that vigour of the plants was not necessarily correlated with resistance. It became necessary for growers and breeders of asparagus to adopt methods for satisfactorily keeping out the disease from the fields and follow pedigree breeding work or the production of resistant strains.

On bean diseases, breeding for disease resistance has resulted in the production of the variety Robust against the bean mosaic and Red Kidney against the anthracnose.

Wisconsin Work with Cabbage

Dr. J. C. Walker has been engaged on plant-breeding work for ten years. In his work, Doctor Walker found pure line for resistance and susceptibility. According to him disease resistance is a single factor which is dominant.

Of the work with other Fusarium-wilt diseases may be mentioned that on peas by Linford (1928) who describes varieties resistant to the disease.

Cabbage Yellows

Cabbage yellows is caused by the fungus *Fusarium conglutinans* Wollenw. The fungus attacks the roots of cabbage in the seed bed or within a short time after transplanting. The infected plants are stunted and the leaves become pale and then yellow. The cabbage may be uniformly attacked or the disease may first appear on one side with the result that a curving of the stem and leaves may follow. Infection begins with the fibrous roots. From the roots the fungus passes to the stem tissues where it may first be noted in the vascular bundles. The vascular bundles first become watersoaked in appearance. Then they become darker coloured and finally assume brownish black. The cortical tissues lying over these bundles gradually die and collapse. The infection of the root and stem of the cabbage causes reduction of the supply of water and food materials from the soil. The fungus continues invading the upper parts of the plants. As soon as this takes place the plants begin to shed their lower leaves. The cabbage may be killed in a week or so after transplanting although some may live for a month or more. Less severely infected cabbages may live through the summer without production of heads.

In badly infected soils in south-eastern Wisconsin the loss ranges from 50 to 95 per cent.

The development of cabbage yellows is favoured by high soil temperature. The disease is worst when a period of dry hot weather prevails after the young plants are set in the field. Once *Fusarium conglutinans* is introduced into a soil it persists indefinitely so that even crop rotation does not affect the disease that it produces.

The disease cannot be controlled by treatment of cabbage seed, seedlings and soil. Steam sterilization is effective but the application of this is restricted to seed bed.

Cabbage yellows can be controlled only by the use of resistant varieties or strains.

In Wisconsin the standard winter varieties of the Hollander or Ball head Type are the ones suited to commercial cultivation, but these are very susceptible to the yellows. Selections were made from sound heads in the worst diseased fields in the autumn. Seeds were raised from these sound heads and the seedlings from these were grown in badly infected soil. The sound plant which were left were saved as source of seed.

By repeated selection, strains of the winter cabbage of the Hollander type were secured. These have proved highly resistant against the cabbage yellows besides possessing the best commercial qualities. The best selected head strain, VIII*a* 25, compared with the commercial susceptible strain behaved as shown in the following table.

Wisconsin Hollander Cabbage ; Second Generation Selections

Percentage Diseased	Per -centage Living	Per -centage of Heads	Av. Wt. of Heads in Pounds	Yield in Tons per Acre
Commercial, Ferry .. 81	46	24.5	2.65	2.1
Resistant, VIII*a* ..251.5	100	98.0	5.45	18.8

Nature of Disease Resistant

There are several bases of resistance in plants. Only two of these may be mentioned in this connection. Conant (1927) working on the black root rot of tobacco caused by *Thielavia basicola* Zopf. found that there is close correlation between the histology of the roots of tobacco and resistance to the parasite. The tips of the roots and the elongating region are highly resistant to the disease, perhaps because the fungus cannot penetrate the epidermis. Further back from the region of elongation the epidermis is broken when the activity of the cambium is in progress. As no cork is present in this region the tobacco roots are very susceptible. *Thielavia basicola* is unable to penetrate cork. As soon as

the roots begin to lay cork on the walls of their cells the tobacco is no longer susceptible to infection.

In the smudge of onion, Walker (1923) noted that although the volatile oil of the onion has a retarding effect upon germination and growth of the fungus *Colletotrichum circinans*, a substance closely associated or identical with the red and yellow pigments is apparently the chief factor causing resistance to smudge infection.

It has been shown in the onion that the colour of the bulb determines the relation to the disease. Red has been found to be resistant, yellow, resistant, but white, susceptible. The question has been raised: Is it anthocyanin or some associated elements that is responsible for this resistance? They have found associated with the coloured scales of the onion derivatives of phenol. They have isolated protocatechic. In the cabbage what is the substance to which resistance is due?

Link and Bailey (1926) working on *Fusarium* species which cause bulb rot of onions first in the field and after harvest in transit and storage found that red, yellow and white varieties are equally susceptible. These fungi readily produce decay when inoculated into wounds of onion bulbs.

Application to Philippine Problems

The knowledge of disease resistance of plants has very important applications to Philippine problems. The question of the control of banana wilt, cabbage wilt, cabbage black leg, a disease which is now present in the region around Baguio, tomato, sugarcane mosaic, pineapple diseases, and diseases of new crops, depends on isolation of varieties or strains which are highly resistant. In the United States the tomato industry is only possible in many sections by disease resistance.

Of course, in addition to the question of disease resistance for the control of plant diseases, it is supplementary to guard against introduction of the disease, contamination of the soil, seed treatment and spraying, important cultural conditions and careful selection of environment to suit crops.—*The Philippine Agriculturist*, Vol. XXII, No. 7.

Potato Growing in Victoria*

No. 3. Change of Seed

By J. T. Ramsay

Potato Expert

For years the changing of seed potatoes from one soil to another has been a subject for contention amongst growers. Some believe that the seed for heavy land should be secured from a crop grown on light soil and *vice versa*, while others consider the change from warm to cold

* For previous articles on this subject *vide* Vol. 13, No. 3 and Vol. 14, No. 1.

districts beneficial. They argue that degeneration can be prevented, and disease-resistant qualities increased by such change.

These beliefs are world-wide—growers in the Southern United States have made a practice of obtaining their seed from the Northern States, while England each year looks increasingly to Scotland for her supplies.

But, however much ground the change of seed theory may have gained amongst growers, no logical reason for it has yet been given, and it might with justice be ranged with many an other theory that has become dissipated with the advance of modern scientific knowledge.

It is not denied that degeneration of seed does occur, but scientific research having disposed of the change of seed theory, inclines strongly to the belief that the cause is to be found nearer home, and that seed selection is the prime factor in governing the improvement or degeneration of ensuing crops. A striking illustration of the value of seed selection was afforded some years ago by the experience of a competitor in a Victorian Agricultural Society's field crop competition for potatoes. This grower had gone to the trouble of selecting seed for 1 acre, especially for the competition, but the quantity he actually secured was sufficient to plant only three-fourths of an acre. Owing to the conditions of the competition the entry was disqualified but, at the request of the grower a comparison was made between this area and the adjoining crop. The soil, manuring, and cultivation in each case were identical, the only difference being that one crop was planted with selected seed, while the other was planted with the ordinary run of seed from the previous season's crop. The following were the yields obtained.

Produce from selected seed ..	.. 9 tons 9 cwt. per acre.
Produce from unselected seed	.. 5 tons 18 cwt. per acre.
Increased yield due to selection	.. 3 tons 11 cwt. per acre.

This illustration shows an increase of over 60 per cent in favour of selected seed, which should impress, even if it does not convince sceptics.

Another experience in support of selection of seed as a means to overcome degeneracy is that of the late Mr. Kenny, then Principal of the Orphanage, Ballarat, who, about 1890, secured a parcel of seed, and by selecting from his best plants each year, not only maintained the productiveness of this strain, but improved it during the thirty-five years of its cultivation there.

In 1914, 1915 and 1916, the Department of Technical Instruction in Agriculture for Ireland instituted tests to ascertain the grounds for the widely held belief in the necessity for a change of seed potatoes, and found that, in the majority of centres, home-grown seed produced the

greatest total yield from which the Department drew the following conclusion :—"That where sufficient attention is devoted to the selection and treatment of home-grown seed potatoes, the frequent introduction of new seed is unnecessary, and as good crops may be obtained from seed grown in Ireland, as from imported seed."

From these tests, and the experience gained in recent years by growers who have adopted scientific cultivation and seed selection methods, it is clear that improvement in potato production may be most certainly and safely obtained by more intelligent attention to manuring, cultivation, and the selection of seed from the most sound and prolific plants. Given seed of a fair to good standard of prolificacy, and a district suited to the cultivation of the potato, there is no need for a grower to import new seed stock, provided he pays attention to the principles of cultivation and selection. The one reason why any parcel of seed gives better returns under the same conditions than another, is that the parcel producing better yields has superior virility.

The admitted fact that Scottish-grown seed, as a rule, produces heavier crops than English-grown seed, is often advanced as proof of the alleged beneficial effect of the change but the obvious reasons for this superiority are:—(1) Because more care is taken in the matter of selection in the case of the former; (2) because the climate of Scotland permits seed to be kept in better condition between seasons than does that of England; (3) because a much greater percentage of the crops of the north is dug in an immature condition than is the case in South Britain.

The opinions of the advocates of change of seed appear to be based on a belief in the inevitable senility of plant life, but no evidence in support of this theory has yet been advanced. As an illustration of its unsoundness, the case of the Ash Leaf Kidney variety, which has been in cultivation for nearly 100 years, and still remains productive, may be cited.

Many growers ignore the fact that cultivated crops of high economic value are grown under what may be termed artificial conditions and when the high standard of these artificial conditions necessary for the best results in production is not maintained, because of bad farming, neglect, or climatic conditions, deterioration of the particular species under cultivation must follow.

When this is more widely understood, and when it is realized that virility of seed depends entirely on careful selection and storage, then only will the Victorian farmer have seized upon the most powerful aids to increased yields.

Under certain conditions, of course, change of seed is justified. Such conditions are as follow :—

The seed may be non-productive.

It may be unsuitable for the soil in which it is grown.

It may be of a variety not desired by the buyers in the place where it is marketed.

It may be comprised of so many varieties as to render it useless for sale for seed purposes.

The crop may be grown in a climate so warm as to make it impossible without facilities for cool storage, to carry seed over from season to season in good condition.

Importing New Varieties

Because of the heavy yields obtained from certain new varieties of potatoes in Scotland, there are many people who advocate the importation of these varieties into Australia in order to increase yields here. Usually these people fail to appreciate the danger of introducing with such potatoes diseases not at present encountered in this country. Two such diseases affecting potato crops in Scotland, and for which no cure has yet been discovered, are black wart (*Synchytrium endobioticum*), and corky scab (*Spongospora subterranea*). These diseases are responsible for heavy losses to growers in the United Kingdom, and should they be introduced into Australia it is possible that, under the conditions obtaining here, they would cause even greater damage.

It should be remembered also that, on the average, climatic conditions in Scotland are more favourable to the production of heavy yields of potatoes than is the case in Australia, while cultivation methods generally are more thorough. These two factors account very largely for the great difference in the average yields of the two countries.

Physical Condition of the Soil

If it is to thrive, the potato crop demands soil that is well drained either naturally or artificially, free working, and of fair depth. Soils ranging between sandy and loamy are the most suitable in which to grow the crop, as on account of their texture they are more easily, and therefore more cheaply, cultivated into the necessary tilth than are the heavier clay soils, and they are not so likely to become set and unkind.

The freer the condition of the soil the more constant is the shape of the tubers to their type, as is instanced by the uniformly good formation of potatoes grown in soils of light sandy character, the tubers there developing without restriction. The crop may be grown in heavy clay land, but good crops are obtainable in clay soils only by the application of heavy dressings of organic manures, and by frequent and perfect tillage. But, as a rule, it is not advisable to attempt to grow these potatoes on heavy clay soils.

There is an idea prevalent, amongst many farmers that new land only is suitable for potato-growing, but this is incorrect. It is quite true that some farmers obtain the best results during the first year or two of opening up virgin land, but this is due to the fact that it has been so farmed as never again to be in a proper physical condition to favour or permit a heavy yield being grown.

New land, as a rule, is permeated by a mass of grass and other rootlets, which, when the land is broken up, act helpfully towards the succeeding crop—physically, by keeping the soil open and by conserving moisture, and chemically, by supplying plant food. The fact that the potato thrives so well under these conditions clearly indicates that the environment is suitable to it; therefore, it is but stating the obvious to say that, if good crops are to be the rule, the conditions prevailing when virgin soil is first broken up should be aimed at when preparing older worked land for the crop, and these can be attained only by adding organic matter to the soil from time to time.

Importance of Organic Matter

Vegetable matter is the most important factor in determining the physical condition of the soil, and it should be borne in mind that the need for good physical condition is greatest where it is most difficult to retain it. In a climate such as that of Victoria where it is customary to experience long spells of dry, hot weather, it is only by the observance of good farm practice that the vegetable matter, or humus content of the soil, can be saved from incineration and maintained at an appreciably beneficial standard. Under the system followed by many at the present time, each succeeding year sees a depreciation, in both the fertility and the mechanical condition of their soils that are under cultivation. Indeed, one often hears of land that is said to be incapable now of producing as heavy crops as it once did, and of land which is said to be quite worked out.

Land that will not grow as heavy crops as ever it did is land which has been maltreated in the farming. The tendency has been to take all possible out of the soil without consideration for the future, with the common result that the humus content has been gradually reduced until frequently a state bordering on absolute depletion has been reached, and the soil thereby rendered difficult to work and uncongenial to crops—particularly potato crops.

Such a system of robbing the land may yield payable returns for a short period, but, if farming is to continue to pay, the farmer must improve the condition of his soil from year to year. It is the greatest

possible mistake to allow land to become run down before attempting to check the depreciation.

If a proper system of farming, *i.e.*, the rotation of crops, periodic green manuring, and catch-cropping is followed, the impairment of the physical state of the soils can be prevented. In the older farmed countries of the world, a profitable physical condition of the farmed lands has been maintained only by the application of large quantities of organic matter, and, if the productiveness of the land here is to be increased or even maintained that same procedure of ploughing in vegetable matter must be followed in order that the condition of the soil necessary for the free development of plants may be secured.

The incorporation of a plentiful supply of organic manure with the soil increases its capacity for the absorption and retention of moisture, thus providing a regular supply for the wants of the potato crop during the period of growth.

This is a considerable factor in reducing the risk of second growth.

(*To be continued.*)

Journal of Agriculture, Victoria, Vol. XXXI, Part 5.

Coir or Cocoanut Fibre.

The coir or fibre obtained from the husk of the cocoanut is a product which has always been exploited by the natives of tropical countries, but it is only within the last ten years that scientific research has been undertaken to investigate more thoroughly the characteristics of this valuable fibre and improve the primitive methods of retting. An interesting report with a complete bibliography of the subject has been written by Dr. S. G. Barker, in which are discussed all the manifold problems connected with the production and utilization of coir. These problems are of prime importance in countries which developed cocoanut cultivation to meet the demand for copra, and then have for some years been faced with an awkward economic situation as a result of the fall in prices. Dr. Barker expresses the hope that the initiative of the Empire Marketing Board may be followed up by further research on cocoanut products (Barker, Dr. S. G., *Coir : Report on the Attributes and Preparation of Cocoanut Fibre*. Empire Marketing Board Publication No. 71, London, 1933, 60 pages).

The qualities of coir make it a highly valued fibre. When properly treated it resists decay, is not disintegrated by bacteria nor harmed by sea water. It is therefore used for making cordage and cables, for making fishing net cord, for tying the rafters of houses, to caulk boats, for mats and matting, for brooms and sacking.

On the other hand, its brittleness, low tensile strength and dark colour place limitations on its use and it has not yet been used as a textile fibre. But it is not suggested that processes might not be found for improving its preparation in such a way that new uses could be found. The first steps that have already been taken in this direction are mentioned in the report.

It will suffice here to mention briefly the first chapters, in which the author deals with the utilization of cocoanut palm products in general, gives statistics relating to coir (Ceylon is at the head of the producing and exporting countries), and describes the botanical nature and habitat of the cocoanut palm.

The first question relating to coir is that of the best time for harvesting the nuts. It is strange that there is not agreement on this question. Most of the experts recommend gathering the nuts before they have reached full maturity, for it is a well-known fact that the percentage of fibre in the husk is higher in young than in fully ripe nuts. It has been held on the other hand that the husk from unripe nuts gives a less glossy fibre and requires longer soaking, but this opinion is not general among experts. The author has obtained excellent results with nuts gathered in Ceylon and India and stored for as long as six months after being transported to England. From an economic standpoint it is important to find processes of treatment which will allow of the use of fully ripe nuts which have fallen from the tree, for all methods of harvesting which necessitate climbing the trees require much labour and are not satisfactory as it is difficult to ascertain with certainty the right stage of maturity.

The husk (mesocarp) is separated from the woody shell (endocarp) of the nut by a simple process consisting in striking the nuts on an iron spike or wooden state or with an iron tool like chopper. One man can split 1,000 to 2,000 per diem.

For a complete understanding of the improvements in retting methods proposed by various workers it is necessary first to know the present process which has been practised for centuries by the natives of Ceylon and India. Choudary describes it as follows. The husks may be soaked in fresh or salt water, but the latter is generally preferred for the reasons explained below. The tidal action is utilized by the construction of pits by the side of the lagoons or backwaters which are provided with a channel to allow the water to be renewed at each change of tide. To accommodate 1,000 nuts a volume of 250 cubic feet is allowed, with a water depth of about 4 feet. The husks are pressed down and covered with palm leaves or are enclosed in a coir net. Whatever method is

followed it is essential that the husks be soaked for a minimum period, which is 8 months in salt water and 6 months in fresh water. It is now known as a result of the research of Fowler and Marsden and of Choudary that the retting process is due to organisms derived from the cocoanut husk direct which in the presence of water are able to disintegrate and destroy the matter binding the fibres together. Regular changing of the water is necessary to prevent the bacteria being poisoned by the products of their action. The blue-black colour of the water is caused by the fibre coming into contact with ferruginous water which forms tannate of iron with the tannin matter in process of extraction from the husk. The brown colour of the water is also due to tannin matter. The reddening of the fibre is caused by exposure of the husk to air, tannin matter being highly oxidisable and readily converted into coloured insoluble phlobaphenes. The material binding the fibres is not the cork or pith of the husk but a gum or hemicellulose which is disseminated throughout its cells, is insoluble in water and is dissolved only by the action of bacteria or by treatment with water under pressure or by chemical agents.

It is to be noted that soaking should not be too long prolonged if loss of colour, strength and brilliancy are to be avoided. It seems strange at first sight that prolonged soaking in salt water should be less injurious than in fresh water. Choudary accounts for this by the fact that the salt prevents over-fermentation. Thus the two main advantages of the salt water method are the constant changing of water due to tidal action and that the time of soaking may be extended to 10 months thus giving greater purity of product with ease of extraction. It has been found that the period of soaking can be shortened by crushing the husks before soaking.

When the retting process is completed the adhering mucilage must be washed from the softened fibre. The husks are then beaten with mallets and the fibre spread out in the shade to dry before being put through a simple willowing or carding machine.

Various methods have been proposed of recent years for improving this primitive method of treatment. Those described in the present work are the Nanji process, the Elod and Thomas process, the Rowell process, the Van Der Jagt process and the "H.G." process, with ionised oil, developed by E. V. Hayes-Gratze.

The Nanji process consists in the treatment of partially crushed green or dry husks with a mixture of lime or sodium carbonate containing a trace of aluminium sulphate at steam pressure for 1–2 hours. The

second and third processes are on very similar lines. The inventor of the fourth process, M. Van Der Jagt, claims that with this method it is possible to extract the fibre in marketable form from fully matured nuts in less than 2 hours by chemical and mechanical means. For details of the process the reader is referred to Barker's report. In the "H.G." process, which is also patented, the husks are compressed or rolled, after which they are passed through one or more washes of hot water, and then rolled again. They are then immersed in a solution of water and ionised oil having a PH value of not less than 7. The fibre thus treated has been spun and woven on machinery of the jute type. The colour of the fibre so produced left little to be desired and it was possible to bleach the fibre to a pale straw colour. For details of the process, see Barker's report.

It should be added, however, that full scale experiments ona manufacturing basis with these processes have not yet been completed, but nevertheless it must be acknowledged that they open vistas of new possibilities.

The pithy and cork-like matter that constitutes as much as 70 per cent. of the husk is at present a waste product. It has been suggested that it might be utilized as a substitute for cork dust or in the composition of manure.

The microscopical, chemical and mechanical characteristics of the fibre have been little studied until recently. The coir cells are very short (7 mm.) and have an average diameter of 20 microns. Of the total area of the cross-section 76.8 per cent. is cell wall and 23.2 per cent. lumen. Under the microscope the fibres take a golden yellow coloration with iodine and sulphuric acid, an intense yellow with aniline sulphate and olive brown with neocarmine W. Schweitzer's reagent gives no reaction.

The most important characteristic of coir is its ability to stretch beyond its elastic limit without rupture, as well as its power to take up a permanent stretch when so loaded. Its elasticity is little affected by prolonged immersion in water.

After reviewing the main qualities of coir the writer suggests various new uses for the fibre. It might, for example, be utilized as a road surface reinforcing medium, for it has been demonstrated that roads which have been laid with jute fabric coated with bitumen require little repairing, and coir might well be used in place of jute.

This outline of Barker's report is by no means complete. It is intended only to lead those interested in tropical countries to read the report itself. W. B.—*International Review of Agriculture*, Year XXV, No. 2.

Water Conservation

In normal years the subject of the weather as a topic of casual conversation is a commonplace with all grades of society. At times like the present when so large an area of the world is suffering from exceptional drought, the vagaries of climate become a matter of the deepest concern which is reflected in the widespread comments of the press. A critical period of this kind helps to impress on the average citizen a more conscious realization of the dependence of his life on water supplies both at home and in distant countries. We are still very little less dependent on the wiles of Nature for our daily bread than were our primitive forbears whom we call uncivilized. The crops of to-day are probably fewer and certainly more fastidious in their requirements than the semi-wild food plants which formed the diet of the population of yesterday. Big strides have been made in the improvement of the plant itself, its food value and yield per acre have been raised enormously by breeding and by the provision of an efficient though semi-artificial environment. But advances along these roads have been quite disproportionate to our ability to control the variations of climate—variations, that is, which are in excess of the normal and which, at various periods in history, have manifested themselves all too strikingly over considerable tracts of the globe.

Presumably because of the long duration of the present drought some writers have been tempted to prophesy the initiation of a permanent change in world climatic conditions. We read of such seemingly fantastic projects as the conversion of the sea into fresh water and of other means of augmenting the deficient supply. These arguments are mainly derived from a study of weather statistics gleaned over a number of years, and the discovery of supposed trends is based on the computation of average or mean values. Whilst it is true that such averages can possess certain comparative value when obtained over a reasonable term of years' records, nevertheless the use of averages over an arbitrary period is beset with many pitfalls. From the agricultural standpoint, a year, though a convenient unit of time, is too long a period to take into full consideration the variations in distribution covering the 365 days which comprise it, and it is this annual fluctuation in rainfall which most concerns the grower of crops. Recently, however, the United States Weather Bureau has reassured us that there is no reason to suppose that the present abnormal figures indicate a permanent drift towards desert-like conditions. More important records indicate a cycle of 30 to 40 years when severe drought may be expected to recur.

On the opposite hand, there is probably some justification for a certain amount of the criticism levelled at municipal authorities or those

entrusted with the public water supply for their slowness in accepting the idea of a serious shortage, and consequently delay in taking the necessary action. It is not intended here either to vindicate or to censure this criticism, merely to offer what seems a plausible explanation for such an attitude of mind. Health departments and their like having large areas to administer, must make use of district records which are averages both for the area concerned and over the customary time periods. Those are the figures upon which they must base their policy, and they can doubtless lay good claim to obtaining a fairly accurate general picture of conditions over the area they serve. It is not implied, of course, that these competent authorities are unaware of the maxima and minima, but it is suggested that the exigencies of large-scale administrative work of this kind perforce entails a disregard for the contingency of extremes. Perhaps when more is known of the cyclic recurrence of extremes we shall have less cause to criticise, for we should then be adequately forewarned; but in the absence of that knowledge it would be gratifying to feel that our equipment was not insufficient to cope with possible climatic disasters.

But the agriculturist cannot look to the local or national authorities for supplying his crops with water beyond the point at which the general scheme of natural or irrigation water supply affects his own property. He has many problems in the consevation of water which only he can tackle. In the very first instance, when the task of choosing suitable land has to be faced, considerations of aspect, slope, drainage, soil texture, height of water-table and precipitation—all factors in water supply—comprise the chief desiderata of selection. To say that water supply is the limiting factor of crop yields is almost a truism, but nevertheless a very significant viewpoint to assimilate. It means that when the yield of a particular crop has fallen below a certain point, further outlay of capital in cultivation or manures will be unprofitable. The solution lies either in irrigation or in growing an alternative, more drought-resistant crop. The modern idea of irrigation requires enormous capital expenditure which no single individual could normally invest. Viewed on the scale of the great irrigated tracts of America or India, for example, works of this kind are essentially capitalist or national in character. But to the small holder who has no recourse to any such co-operative supply, a study of the primitive methods of water lifting and transport, such as are still in use by the Chinese coolie or Egyptian fellah, might well be considered in times of water stress. At first sight objects of incredulity, their "devices" should ultimately evince admiration for their efficiency relative to cost of erection and maintenance.

The undertaking of a thorough soil survey which would link rainfall data to the water requirements of the plant—by assessing the importance of surface run-off, depth of percolation, fluctuations in level of subsoil water, capillary forces and other pertinent facts—should be as much an essential preliminary to the formulation of a water conservation scheme as the engineer's surveys of land levels and natural sources of supply. Rainfall is without doubt a useful statistic in certain cases, but without the relevant data concerning evaporation, rate of entry into the soil, and sundry other factors it is comparatively useless as an index of the amount of water available to the plant. The rapid strides which in recent years have been made in the field study of soil conditions in relation to vegetation should be taken advantage of by considering them in conjunction with meteorological records in the formulation of national schemes of conservation.

The area affected by the drought in America is continent-wide, and the relief measures already instituted may seem, to those who are accustomed to insular conditions, to be on an equally prodigious scale. In the early months the drought was rather welcomed as likely to alleviate the problems of unsaleable stocks, and to bring about a rise in crop prices. Its persistent severity has now shattered that complacent attitude. Press reports relate that over two million cattle in stricken areas have been bought by Government which is slaughtering them at the rate of 200,000 a week for the provision of canned meat to be distributed to the starving. Assisted migration and other temporary palliatives of a political tone indicate that the situation is now very seriously regarded. Of a more permanent nature, the great dams on the Missouri and Columbia rivers, originally designed to prevent floods and provide electric power, are to be utilized in great irrigation schemes. Here is provision against both climatic extremes, and the success of this single scheme to serve a dual purpose will doubtless be watched with much interest. Certainly no less concern will be shown in the outcome of their other major project for providing a wind-break stretching across the continent from the Canadian border to Mexico, a forest covering 20 million acres comprised of mile-wide strips, each 1,000 miles long. This gigantic experiment raises the important general issue of the relation between forests and water conservation. The problem gains additional interest in the light of the much-disputed question as to whether or not the presence of a forest can increase or otherwise influence precipitation. No scientific proof has yet been adduced to prove this point, but from what evidence exists it seems that such effect as it may exert is relatively insignificant by contrast with the influence of a forest on soil and plant

evaporation, and its prevention of excessive surface erosion by holding up the flow of water down steep-sided slopes.

The dry season in the tropics is typically associated with the steady blowing of the Trade Winds which are an added menace to the risks of drought. The extent of mechanical wind damage is, however, probably in many cases out-weighed by the loss in yield which follows excessive evaporation. In addition, wind over large open tracts blows off the top layers of soil with serious loss of fertility. Islands are as a rule protected along their windward coasts by wind-break reserves. But here, as with water supply, the onus is on the individual planter to protect his crop from the prevailing winds. If he has no natural barrier in forest or mountain range, he must plant his own wind-break. For this purpose he has only commonsense to guide him in the selection of suitable trees. There is unfortunately a very striking lack of knowledge on this question —scientific data is urgently required to answer questions such as rates of growth, branching habit, root-system and spacing distances, which might help in the selection of a wind-break which at the same time will not unduly impoverish the soil. Probably the ideal form of wind-break bearing in mind the utility of leguminous species, is one made up of a central row of tall trees, smaller trees on either side, and outside these again dwarf bushes to fill up the gaps between the lower branches. This type will give an inclined surface to divert the air currents upwards. There is scope for interesting research here, and such studies should form an integral problem in water conservation.

Drought resistance in plants is not a simple attribute, but the result of the interplay of a number of complex physiological factors. Some of these find expression in external morphological characters such as reduced transpiring surface, hairiness, sunken stomata and others, which we call "xerophytic": but more important are the internal factors, such as an increased osmotic pressure of the cell sap, which enable the plant to obtain sufficient water from heavily depleted soil reservoirs. It should not be overlooked. Moreover, that the possession of a deep root-system is just as much a xerophytic character under certain circumstances as, for example, succulence or a prostrate habit. Breeding for drought resistance is thus not a straightforward issue, but one requiring highly specialized knowledge, such as the Russian botanists have been pursuing with such energy during the past few years. This intricacy is but another facet to the general problem of water conservation, a problem urgently in need of greater co-operative effort on the part of engineers, botanists, soil chemists, meteorologists, physiologists and geologists alike. Thirty to forty years is none too long a period if agriculture is to be prepared

to combat the next world drought in the rainfall cycle, better than it has weathered this one.—*Tropical Agriculture*, Vol. XI, No. 10.

Press Communique

Coriander

Coriander is a commodity which rarely appears in statistics or official publications but which is a fairly important condiment in Indian cookery and is one of those minor crops which give a fairly high return to the cultivator. Grown mainly for internal consumption, we have nevertheless a substantial export which at present price is valued at about Rs. 5 lakhs per annum, our principal customers being the Straits Settlements and Ceylon.

During the visit of the Ceylon Trade Deputation in 1933 mention was made of the fact that Indian Coriander seed seemed to be losing ground in the Ceylon market and a complaint was received both in regard to its flavour and the purity of the samples. In particular it was stated that the Coriander seed shipped from India to Ceylon contained disproportionate amounts of husk and dirt and compared unfavourably with Coriander from Morocco.

Through the courtesy of the Chief Collector of Customs, Ceylon, the Imperial Council of Agricultural Research was able to obtain samples of Russian Coriander, Moroccan Coriander, Tuticorin Coriander and Rangoon Coriander as imported into Ceylon. For comparison typical trade samples of Coriander from the Udamalpet market in the Coimbatore District were obtained. These were examined in detail by the Agricultural Chemist to Government, Madras, whose report is being published in the forthcoming number of *Agriculture and Live-Stock in India*. The main results are of general interest as they provide a striking example of Indian produce of intrinsically good quality losing ground by reason of adulteration of the clumsiest character. The Tuticorin sample of Coriander contained about 3/10th per cent of stalk—a figure which coincides closely with that for Moroccan Coriander and the extraneous seeds and other grains amounted to also 3/10th per cent again the same as Moroccan Coriander but the extraneous material, in other words dirt, amounted to over 20 per cent. as against less than one per cent for Moroccan produce. A sample from Rangoon contained 1.68 per cent stalk which was certainly excessive but contained only 0.10 per cent other grains and less than 4 per cent of extraneous material. The figures for local Coimbatore Coriander as sold in the bazar for local consumption are most instructive—other grains amounted to one-ninth per cent and stalk

to one-eighth per cent, so that taking it all round, the Coimbatore district sample was the cleanest of all those examined. Three Russian samples contained very little stalk but higher amounts of "other grains and seeds" than the Indian samples.

The essential oil content, which may be said to determine the pungency and efficacy of a sample of Coriander, was also determined and the Indian samples were in no way inferior to the Moroccan samples but on the whole had rather a higher trend. In regard to the flavour of the seed and the characters of the essential oil, the Indian samples were found to be highly satisfactory.

It is obvious that with even reasonable attention to cleanliness, the Indian Coriander can easily hold its own and it is important that steps to this end should be taken for India cannot afford to lose any of its markets for these minor agricultural products which in the aggregate mean so much to the cultivator and market gardener.

CHARAN DAS,
Secretary,
Imperial Council of Agricultural Research, Simla.

The Maynard Ganga Ram Prize.

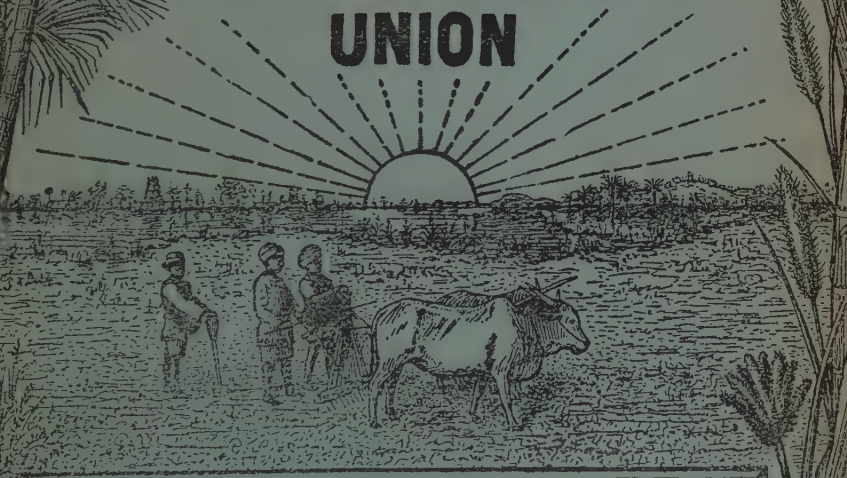
In 1925 the late Sir Ganga Ram, Kt., C.I.E., M.V.O., R.B., Lahore, with that generosity for which he was so well known, handed over to the Punjab Government a sum of Rs. 25,000 for the endowment of a prize of the value of Rs. 3,000 to be called the Maynard Ganga Ram Prize and to be awarded every three years, for a discovery, or an invention, or a new practical method which will tend to increase agricultural production in the Punjab on a paying basis. The competition is open to all throughout the world. Government servants are also eligible to compete for it.

Entries for the next award were invited by the 31st December, 1933. None of the entries was considered to be of sufficient merit and it has been decided by the Managing Committee of the prize that the award should be postponed for another year and that further entries should reach the Director of Agriculture, Punjab, Lahore, on or before the 31st December, 1935.

1843-34. Printed at The Bangalore Press, Mysore Road, Bangalore City,
by T. Subramania Aiyar, Superintendent.

EXD.
IMP. INST. ENT.
LIBRARY
18 JUN 1934
5.6

THE JOURNAL OF THE MYSORE AGRICULTURAL & EXPERIMENTAL UNION



Vol. XIV] [No. 1

PRINCIPAL CONTENTS.

Bee-Keeping as a Subsidiary Occupation for the Cultivators in the Mysore State—By T. V. Subramaniam and B. Krishnamurti.

Sugarcane Breeding Work in Mysore—By Dr. V. K. Badami, L.Ag., Ph.D. (Cantab.), Economic Botanist, Mysore Dept. of Agriculture.

CONTENTS.

	Pages
Bee-Keeping as a Subsidiary Occupation for the Cultivators in the Mysore State—By T. V. Subramaniam and B. Krishnamurti	1—15
Garlic Cultivation in Hassan Taluk—By N. Ramanna, B.Ag., Agricultural Inspector	16—19
Agricultural Co-operation and Co-operative Cotton Sale Work—By G. S. Rangaswamy Iyengar, L.Ag., Agricultural Inspector	19—22
Are Sprayed Grapes Poisonous?—By S. V. Venkatarayan, Senior Asst. Mycologist	22—24
A Note on the Scope of Simplifying Areca Curing Methods in the Malnad and Eliminating Waste Therein—By A. K. Yegnanarayana Iyer, M.A., Dip. in Agri. (Cantab.), N.D.D., Deputy Director of Agriculture ..	24—29
Sugarcane Breeding Work in Mysore—By Dr. V. K. Badami, L.Ag., Ph.D. (Cantab.), Economic Botanist, Mysore Dept. of Agriculture	29—36
SELECTIONS—	
Top Working Old Coffee Trees—South-West Monsoon in India—A Few Hints on Sharpening a Steel Ploughshare—Russian Method of Artificial Insemination—Conservation of Farmyard Manure at Lyallpur—Planting Young Fruit Trees—Indian Central Cotton Committee—Potato Growing in Victoria—The Soy Bean as Human Food	37—56

THE JOURNAL OF THE MYSORE AGRICULTURAL & EXPERIMENTAL UNION

Vol. XIV] [No. 2

PRINCIPAL CONTENTS.

Extraordinary General Meeting of the Union—Proceedings.

CONTENTS.

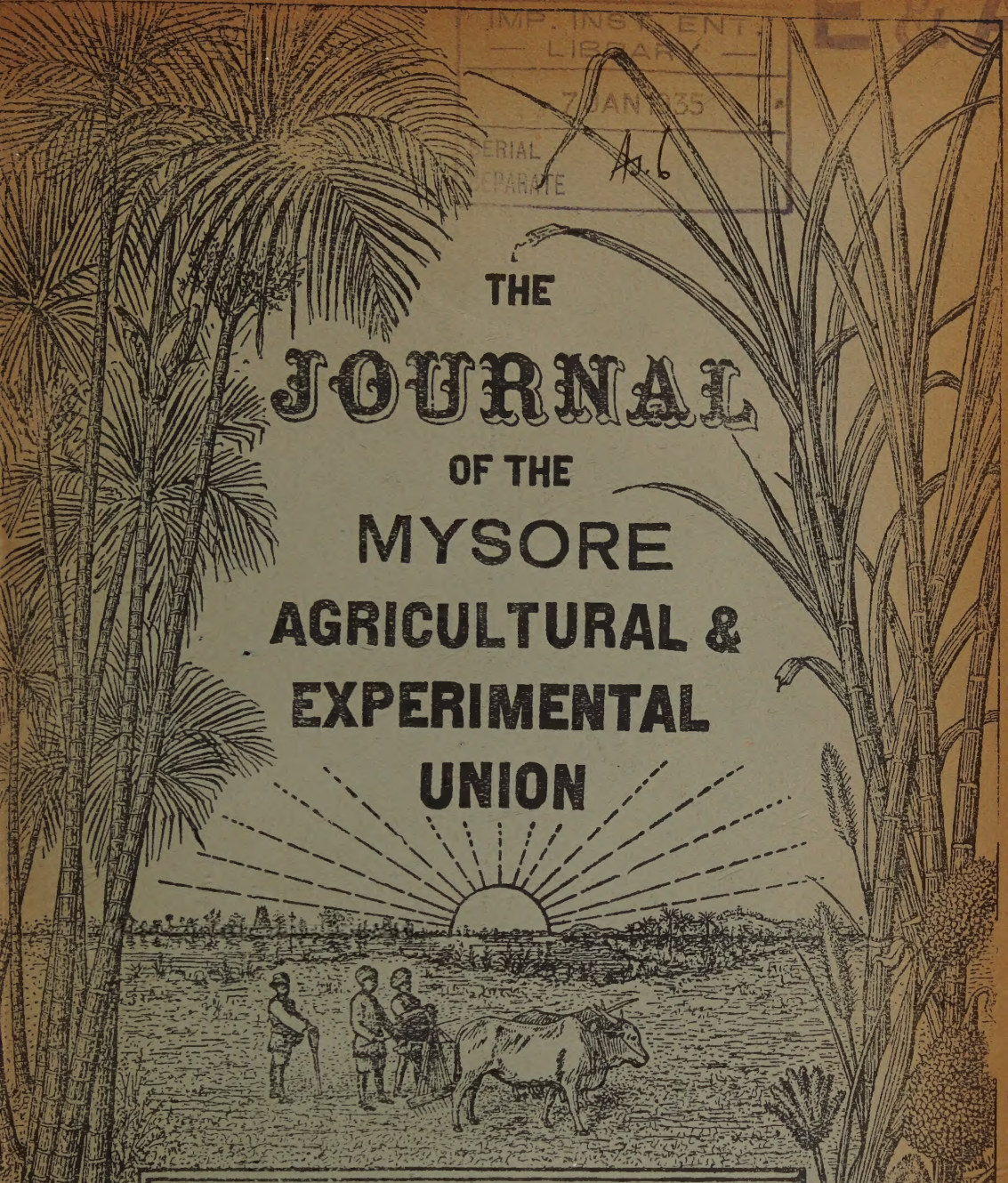
	Pages
The Control of Rinderpest with Special Reference to Goat-adapted Virus as a Vaccine—By S. D. Achar, G.B.V.C., P.G. (Punjab), Superintendent, and G. N. Srikantiah, G.M.V.C., Veterinary Inspector, Mysore Serum Institute, Bangalore	57—61
Efficiency of the Open Pan System of Making Sugar—By B. Narasimha Iyengar, B.A., Ph.D., Agricultural Chemist to the Government of Mysore	61—66
The Agriculturists and the Co-operative Movement—By G. M. Mehkri, B.A., LL.B., Registrar of Co-operative Societies in Mysore, Bangalore	66—69
Proceedings of the Extraordinary General Meeting— Secretary's Report. Dr. Coleman's Letter of Resignation. Resolutions, Dr. Coleman's Reply	70—77
Hebbal Agricultural School-Day— Principal's Report. Director's Speech. Press Report of Chairman's Remarks	78—86
SELECTIONS— Dr. Leslie C. Coleman, M.A., Ph.D., C.I.E. (*An Appreciation*)—A Renewable Edge for Ploughshares—Effect of Environment on Cotton—The Root System of *Coffea arabica*—Notes on the Cultivation of the Pine-apple (*Ananas sativus*)—Tobacco Culture in Southern Rhodesia	87—111

NOTE

Members and Subscribers are requested to intimate promptly to the Union Office change of their address as otherwise, letters and journals sent to them are likely to be delayed or missed altogether.

IMP. INSTITUTE
LIBRARY
7 JAN 1935
SERIAL
SEPARATE
A.6

THE JOURNAL OF THE MYSORE AGRICULTURAL & EXPERIMENTAL UNION



Vol. XIV] [No. 3

PRINCIPAL CONTENTS.

Economic Reconstruction in Europe.
Development of the Irwin Canal Tract.
Sugarcane Borers and their Control in the Mysore State.

CONTENTS.

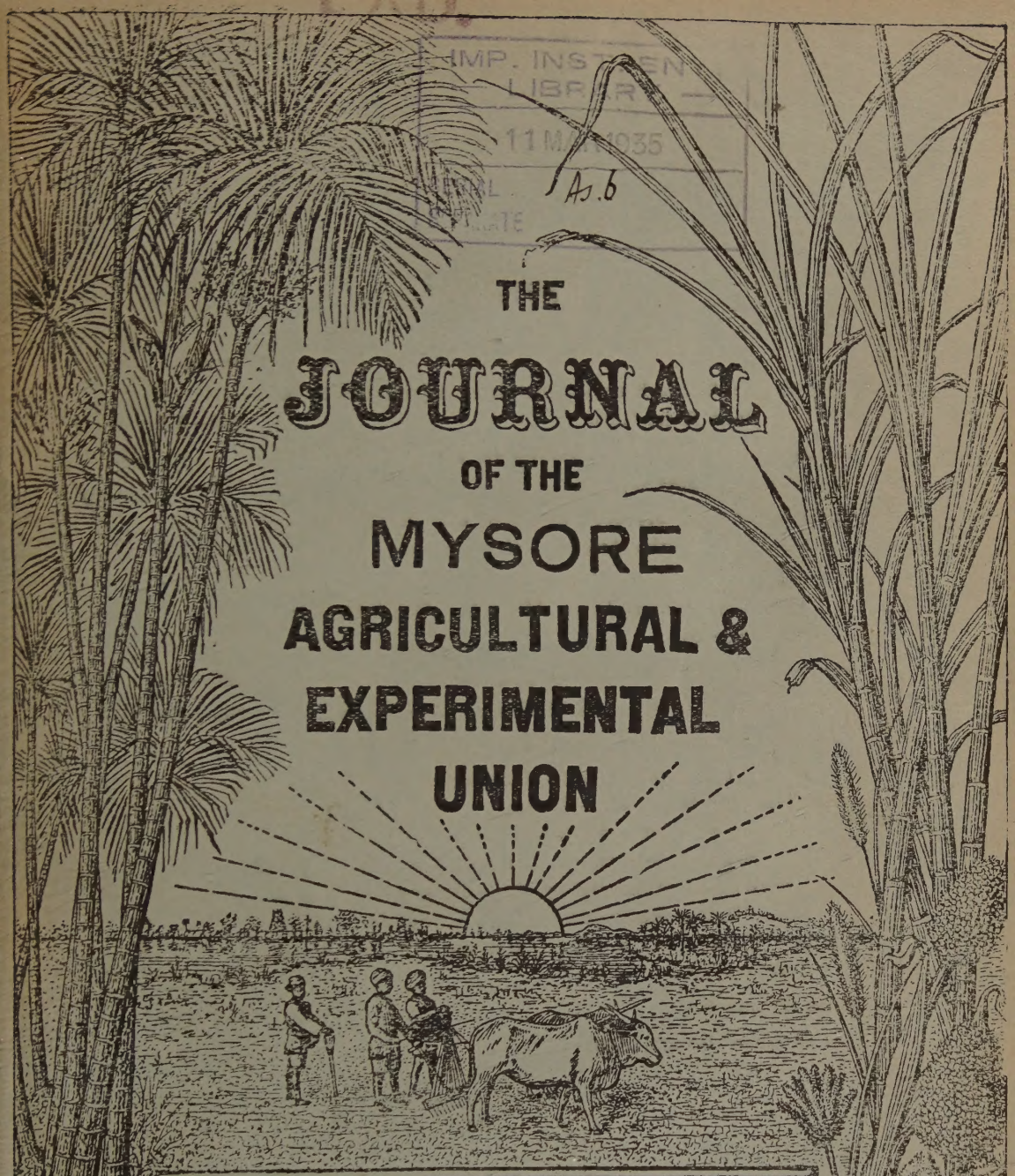
	Pages
Economic Reconstruction in Europe—By S. V. Ramamurthi, M.A., I.C.S., Director of Agriculture, Madras	113–122
Development of the Irwin Canal Tract—By B. Narasimha Iyengar, B.A., Ph.D., Deputy Director of Agriculture, Mysore State	122–130
Sugarcane Borers and their Control in the Mysore State—By T. V. Subramaniam, Dip. Agri., Offg. Entomologist, Department of Agriculture, Mysore State	130–139
SELECTIONS—	
Topping and Suckering of Tobacco—Soil Erosion Losses in Terms of Money—Flaked Coffee—Derris Root as a Netherlands India Export Product—Some Aspects of Soil Erosion—Breeding for Immunity—Vernalization : A New Method of Shortening the Vegetative Period of Plants—Flowering, Pollination and Natural Crossing in Rice	140–168

NOTICE

Members and Subscribers are requested to intimate promptly to the Union Office change of their address as otherwise, letters and journals sent to them are likely to be delayed or missed altogether.

IMP. INSTITUTE
LIBRARY
11 MAR 1935
Ag.6

THE JOURNAL OF THE MYSORE AGRICULTURAL & EXPERIMENTAL UNION



Vol. XIV] Published February 1935 [No. 4

PRINCIPAL CONTENTS.

The Mysore Cattle-Breeding Station, Ajjampur—By C. Narasinga Raju, L.Ag.

Casuarina Plantations in Mysore—By H. Sreenivasa Rao.

Rural Economy in Mysore—By M. S. Ramachandra Rao, B.A., B.L.

CONTENTS.

	PAGES
The Mysore Cattle-Breeding Station, Ajjampur—By C. Narasinga Raju, L.Ag.	169—175
Casuarina Plantations in Mysore—By H. Sreenivasa Rao, Retired Deputy Conservator of Forests ..	175—180
Rural Economy in Mysore—By M. S. Ramachandra Rao, B.A., B.L., Senior Assistant Commissioner ..	180—185
Urine Hormone Injection for Stimulation of Fertility in Cattle—By Lieut. A. A. Monteiro, G.B.V.C., Live-Stock Expert	185—188
Botany of Groundnut (*Arachis hypogœa*)	188—194
Programme of Experimental Work for 1935—Circular ..	195—197
SELECTIONS—	
Chemical Composition of the Mango—Record Yield of Sugarcane in Hawaii—Xylamon, A New Specific for Preserving Wood from Insect Attacks—Security for the Individual—Grafted Coffee—Determination of Live-Weight of Cattle by Measurement—Vernalization—Disease Resistance in Plants—Potato Growing in Victoria—Coir or Cocoanut Fibre—Water Conservation	198—223
Press Communique	223—224
The Maynard Ganga Ram Prize	224

NOTICE

Members and Subscribers are requested to intimate promptly to the Union Office change of their address as otherwise, letters and journals sent to them are likely to be delayed or missed altogether.